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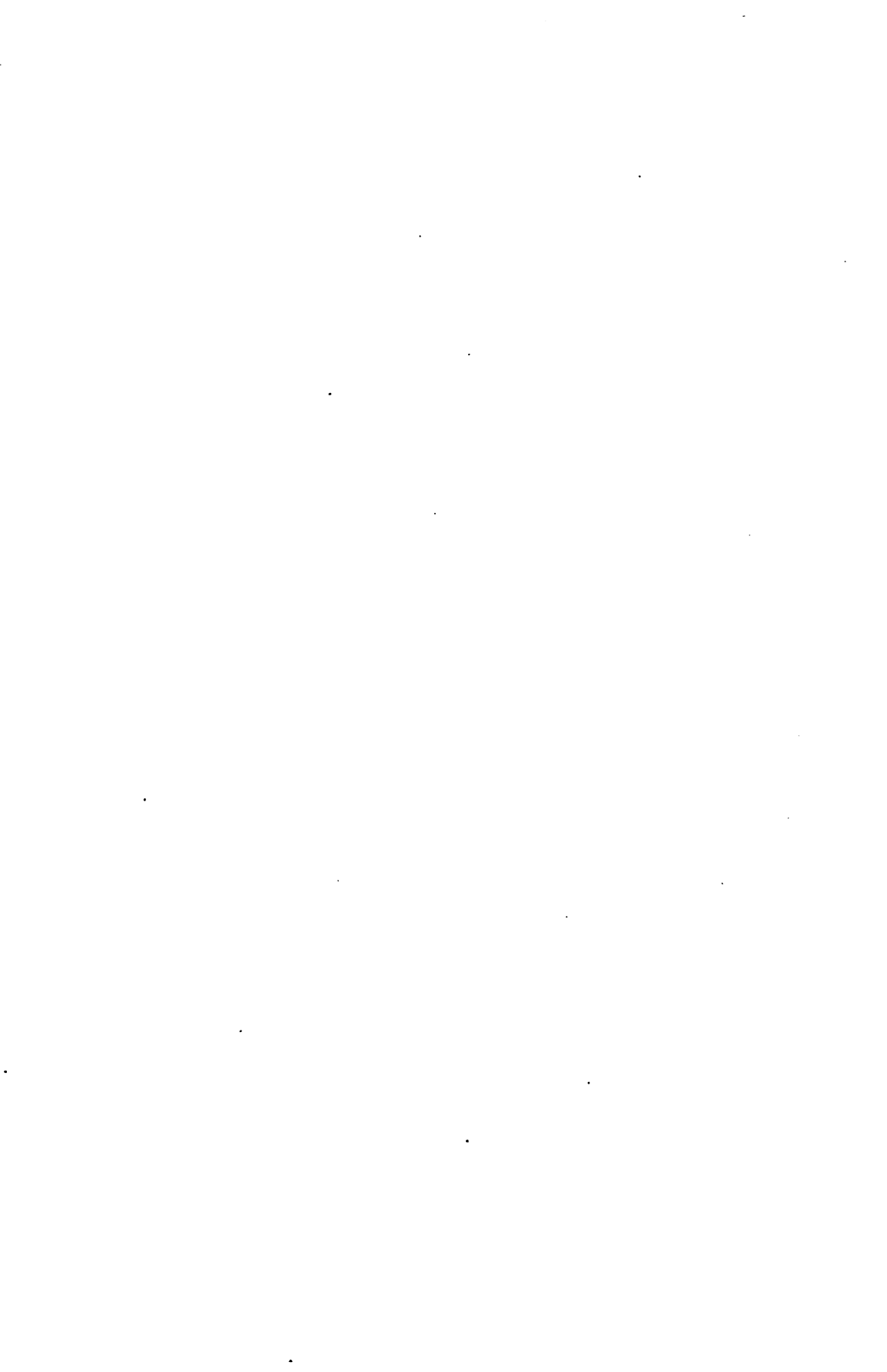
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A TREATISE
ON
CLINICAL MEDICINE

BY
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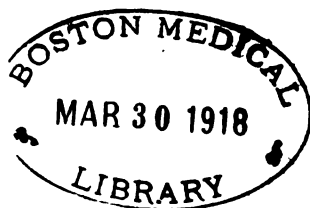
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PREFACE TO THE SECOND EDITION

IN this edition I recapitulate the subjects treated in the former edition, such as that of "Catching Cold," and the classification of diseases according to their exciting causes.

The progress of medicine continues to be so great and varied that I would draw particular attention in this edition to the applications of the different rays of light in both the diagnosis and treatment of the malignant diseases of carcinoma and sarcoma. Rays of light are much more numerous than those rays which are visible to the unaided eye, and hence I would draw attention to the rays emitted by radium and the mysterious emanations called after their discoverer, the Röntgen rays, besides the well-known actinic rays to which we owe the various processes of photography.

NEW YORK CITY,
January, 1918.

WILLIAM HANNA THOMSON.

PREFACE

A TREATISE on Clinical Medicine should chiefly consider those subjects which concern the physician when he deals with the sick. Knowledge gained in the laboratory or at autopsies, while indispensable, yet should in time precede all prescribing. It is the condition of the living patient which then demands exclusive attention.

We begin, therefore, with the meaning of certain common but always important symptoms. In each instance that meaning is neither vague nor uncertain, but rather should be thoroughly understood before we go any further in dealing with the case.

A chapter then follows on the use of remedies and how they can be most conveniently classified according to their special applications.

Then follows the section on that greatest cause of disease and death, namely, infections by living micro-organisms. A good classification of these agents would be of great service, and such is attempted.

The last section deals with diseases of particular organs and tissues.

Throughout the book the aim of the author has been to serve the physician while he is actively engaged in the performance of his professional duties.

WILLIAM HANNA THOMSON.

NEW YORK CITY.

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CLINICAL MEDICINE

PART I

INTRODUCTION

CHAPTER I

"CATCHING COLD"

OUTSIDE of hot, moist climates, the most common cause of disease and of death is from "catching cold." I first drew attention to the etiology and mechanism of this derangement in my inaugural as president of the New York Academy of Medicine in 1899. Yet it should be clearly understood that this disorder, however local, is always caused by an interference with the supply of arterial, and not of venous, blood to the part. This fact was plainly illustrated by the experiment of Overbach, who found that clamping the renal arteries for only forty minutes, so as to obstruct the flow of blood through the kidneys, was followed by albuminous urine for twenty days. We may conclude, therefore, that any local shutting off of arterial blood will promptly induce nutritive changes in the territory of that arterial distribution, which are at least analogous to the local inflammatory changes which we trace to "catching cold."

Now the arterial flow, in distinction generally from the venous, is under the regulation of a special department of the nervous system, called the vasomotor nerves. This is well shown in the circulation of organs which are in symmetric pairs, such as the two eyes, the two ears, the two hands, and the two feet, but this association does not obtain in the pair-organs which are not symmetric, such as the two lungs and the two kidneys. As to the symmetric organs, if thermometers be placed in the axillæ, and then one thermometer be held in the left hand while the right hand is plunged in ice-water, the thermometer

in that hand will fall 2° to 5° F. from arterial contraction in it, while those in the axillæ are unaffected. If the semitranslucent ears of a rabbit are held up to the light the readily seen pulsation of the arteries in one ear is found to cease at once when the other ear is pinched. Now, Overbach's experiment shows that the integrity of the tissues of a most important organ can be seriously deranged by only a very temporary withdrawal of arterial blood.

In the first place, it is evident that "catching cold" is a very different thing from being chilled by cold; that is, from a general cooling of the body; for its most typical, as well as disastrous, results may occur while a person sits with his entire body wrapped carefully in winter clothes, but the feet meantime soaked, because he went out without his rubbers into melting snow. A cold draft on the back of the neck, however induced, may, according to individual susceptibility, cause a rhinitis, a pharyngitis, a laryngitis, a bronchitis, a pneumonia, or a pleuritis. How do such purely local impressions of cold occasion such widely distributed organic mischief? As we have remarked, we must look to the nervous system for our chief explanations. One of the first clues toward the solution of this problem was furnished by an observation of Cohnheim, that, after long-continued anemia of the rabbit's ear by ligature, the blood-vessels became so permeable that the restoration of the normal circulation was followed by pronounced edema of all the tissues and degenerative changes in their cells.

The principle, therefore, which we would elucidate here is that the integrity of the tissues of the body depends upon the constant circulation through them of arterial, and not of venous, blood. Whatever interferes with the circulation of arterial blood, though it be but a short interference, nevertheless produces serious damage to the tissues. Guided by this principle, we can understand what "catching cold" means, because every organ of the body, particularly if it be very vascular, is sensitive to the withdrawal or interference with its arterial circulation, and hence this leads us to inquire into the special mechanism of the arteries as they are governed by their vasomotor nerves.

The vasomotor nerves are but rarely acted upon by a general stimulus. Instead, vasomotor stimuli are definitely local, and yet subject to certain special laws. A study of these laws will throw much light upon our subject of "catching cold." Thus, as we have seen, the first law is illustrated by the intimate association of the vasomotor nerves supplying symmetric organs in pairs. In the case of the hands I once made use of this property in a boy who had a pistol shot

perforate the palm of his hand so as to sever the palmar arterial arch. This necessitated both the cut ends being ligated, but the hemorrhage was so troublesome that I could not secure the vessels until his other hand had been dipped in ice-water, whereupon the bleeding was checked enough for me to find and tie the vessels without difficulty.

A second law is the intimate association between the vasomotor nerves of any area of the skin and those of the internal parts underneath that area. This is an important law, as it affords the explanation of a great many clinical facts. Thus, external applications, according to their nature, can produce marked stimulative or else sedative impressions upon the circulation of the parts underneath that area. This explains why poultices may so relieve pain and inflammatory irritation when applied to the skin; but likewise we find this law operative where it is important to stimulate the circulation in the stage of venous stasis.

Thus, after the subsidence of the acute stage of inflammation, we have a powerful stimulant to the internal circulation by dry cupping, which is especially useful in the bronchitis of adults. Likewise the application of a blister is actively stimulant to the internal circulation, but should not be applied in the first stage of the inflammation.

These considerations lead directly to the whole subject of counter-irritation. Thus, the effect of local bloodletting is always sedative. I have relieved the agonizing paroxysms of dyspnea from a thoracic aneurysm by a single leech applied at the notch of the sternum. A further illustration of this law is found in the saving of life from a quickly fatal postpartum hemorrhage by dashing cold water upon the abdomen or, better yet, by the sudden, intense cold of the ether spray. Of course, this arrest of the hemorrhage is not due to the general cooling of the parts involved, but acts only through reflex vasomotor association.

But this law has also an obverse application of much practical importance. Every internal inflammation causes a marked hyperesthesia of the skin over the inflamed organ, which leads to any irritation of it being reflected inward to the aggravation of the inflammation. I once saw a distinguished clinician expose the chest of a woman with pericarditis for nearly an hour, so that each of his students might successively listen to the pericardial rub. The result was that in a very few hours the patient's life was despaired of from a spread of the inflammation to the whole pericardium.

Another important law is, that through the vasomotor system special associations occur between certain widely separated parts

of the body. All vasomotor nerves are particularly susceptible to the irritant impression of cold. This is illustrated in the case of the association existing between the feet and the circulation of the pelvic viscera. So girls can have recourse to a very dangerous suppression of the menses by putting their feet into cold water. It is surprising how long this injurious impression is retained by the pelvic nerves, so as to cause long-continued amenorrhea. On the other hand, I have found no agent so effective in restoring the function of menstruation as that of dry (not moist) heat, applied for prolonged periods to the feet. Likewise, no patient with an irritable stricture of the urethra should allow his feet to get wet and cold, and the same may be said of cases of cystitis. Also due to the same vasomotor association, if profuse bleeding occurs during operations about the rectum, the hemorrhage may be largely controlled by immersing the feet in cold water.

But the vasomotor nerves of the feet form another association which is of much importance, and that is with the circulation of the pharynx and the larynx. Everyone knows that getting the feet wet may quickly produce a sore throat, if not an attack of hoarseness, extending finally into bronchitis.

Still another important association is between the nerves arising at the nape of the neck and the whole arterial circulation of the head and face; in fact, we may say that at the nape of the neck is the chief executive office which presides over the whole circulation above the diaphragm, including, of course, the circulation of the mucous membranes. One domestic remedy, for example, was to check nose-bleed in a child by slipping a cold key down the back of its neck. How local the primary excitation may be is shown by the results of exposing the back of the neck to a cold draft of air. The most extensive inflammation of mucous membranes may result from a prolonged exposure, though the rest of the body may be warmly clad. Nasal catarrh or, in fact, catarrh of the whole respiratory tract may soon follow from thus "catching cold."

But a fact of the highest moment connected with "catching cold" is, that by the local damage to an internal part the way is opened for infecting micro-organisms of the most varied kind to enter the system. Many of these infecting agents may be found throughout life occupying the mouth and throat, but doing no harm so long as the epithelium lining of the mucous membrane is intact; such is the case with the pneumococcus and a whole host of similar and powerful infecting agents. The demonstrated seasonal relationships of pneumonia show this very

clearly. These infecting micro-organisms are as little able to penetrate a healthy mucous surface as the streptococci and staphylococci, which always swarm on the skin, but can do no mischief until the surgeon ventures to make an incision in it.

These vasomotor associations have their widest illustrations in the causation and course of bronchitis. Sometimes getting the feet wet begins, as we have explained, a cold which first makes the voice hoarse, and then, from the larynx, proceeds steadily down the trachea and larger bronchi until the smaller air-tubes become involved. Oftener than that, however, the vasomotor centers at the nape of the neck set up a catarrhal inflammation of the nasal passages, and then, with this derangement in the beginning of the breathing apparatus, it progressively invades the whole respiratory tract. Yet just this sequence occurs also when this tract is directly invaded by the specific infections of influenza, measles, and whooping-cough. But what we particularly wish to explain here is the mechanism of the many fatal complications of bronchitis.

We begin with the disasters which follow upon the plugging of a main bronchus by the accidental lodgment in it of a foreign body. If this be not removed, death inevitably ensues from a most disorganizing pneumonic process of the part supplied by the bronchus, in which not only are all the air-vesicles wholly destroyed, which they are not in croupous pneumonia, but the interlobular as well as the inter-vesicular connective framework is rapidly damaged. No ruin of pulmonary tissues compares with this for completeness.

Now, it should be borne in mind that both the larger and the smaller bronchi should never contain anything but air. Their walls are simply moistened by a bland, slightly saline fluid, and in no part of the body is the saying more true that no mucous membrane should ever secrete mucus. When, instead, its surface is coated with mucus, it is already in a morbid condition, denoting inflammation. In the bronchi this is doubly true, for secretions there, no matter how fluid, are, to all intents and purposes, foreign bodies, and must be got rid of. If they cannot be got rid of, the part supplied by that bronchus is subject to the same disorganization as that described following the plugging of a main bronchus. It is then that we have a localized, but ruinous bronchopneumonia, however small its area may be.

Bronchopneumonia, therefore, occurs in every disease accompanied by bronchitis whenever, as in children, the powers of expectoration are feeble, particularly in measles and whooping-cough, and is the most common cause of death in all such affections. But its initial

mechanical cause should not be lost sight of, the practical aim always being to make the secretions so fluid that they can easily be coughed away. In adults this is usually accomplished with ease. If the secretion, however, is very viscid, the coughing is hard, and in chronic cases leads to emphysematous overdistention, if not rupture, of the air-vesicles. In infants, as already explained, the immediate results are very serious. The small occluded bronchi now lead to the same disorganizing process in the little lobules supplied by the bronchus, which occurs as the result above described accompanying occlusion of a main bronchus. Scattered pneumonic processes are, therefore, found through both lungs, for bronchitis, unlike croupous pneumonia, is a bilateral affection. In some cases, however, the plug in a small bronchus may act as a valve, interfering with the inspiration but not with the expiration, thus leading to atelectasis of the lobule, so that in bronchopneumonia we find both pneumonic consolidation of lobules along with collapsed lobules, either condition, of course, equally interfering with the breathing. In infants, therefore, this whole process leads to most distressing efforts to get air. The little patients toss from side to side in their vain endeavors to breathe, until signs of carbonic-acid-poisoning show the last effects of gradual suffocation; but we meet with practically the same conditions in aged patients from their feeble powers to expectorate. Remembering, however, the purely mechanical operation of their respiratory obstruction, I once had an old lady, eighty-four years old, mother of a prominent New York judge, raised feet upward by her nurses, while her head touched the floor, and while in this position assisted her expectoration by pressure on the sides of the thorax during expiration. She thus got rid of large quantities of mucus, and was soon restored to bed quite comfortable, ultimately recovering.

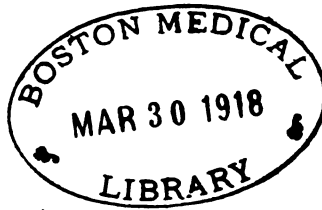
In no disorder of the lungs does this morbid condition so facilitate infection by every variety of micro-organism, including tuberculosis, a not uncommon sequel, especially after measles.

Treatment.—The various conditions above described afford many indications for treatment. Thus, chronic nasal catarrhs point to a weakened susceptibility of the vasomotor centers at the nape of the neck. Nothing so restores the tone of these weakened centers as cold properly applied. Thus, a cold bath or shower-bath invigorates the circulation, provided always that the reaction from the impression of cold is complete, but if not, or equally imperfect reaction occurs, the patient is worse off than ever; hence, chronic nasal catarrhs are best treated by sudden and very brief douching of the back of the

neck with cold water, to be followed by active dry friction, to assist or to promote the restoration of the circulation in the parts. During the douche the hair should be carefully protected from the water, for wet hair would only prolong the injurious effect of chill. Meanwhile the nose itself may be treated with insufflation of a fine powder, composed of 2 drams of subcarbonate of bismuth with 6 gr. of aristol.

Bearing in mind what we have said about internal inflammation causing hyperesthesia or great sensitiveness of the corresponding area of skin over the seat of the inflammation, any area of chronic inflammation should have the corresponding cutaneous surface carefully protected. In health, if a cold hand be placed suddenly over the precordium, the heart will give a bound, but so all cases of heart trouble, whether the result of pericarditis or endocarditis, are very sensitive to surface impressions which would not normally be felt. This explains the beneficial results following applications of large belladonna plasters, which should cover the whole area of the skin over the heart, but these facts are equally applicable in all chronic inflammatory conditions, whether of the lungs or of the pleura. Chest protectors, on that account, are reasonable. I prefer the application of cotton batting to any other such measure. Similarly, every patient with chronic diarrhea should have his abdomen covered by some equivalent protection. In chronic, long-standing bronchitis I have the patients wear both shirts and drawers made with perforated chamois skin, worn just over a light undergarment. I have often been told by such patients that they could spend their winters at home, when before they used these protections to the skin they were unable to do so. Osler says, in his "Practice of Medicine," "Thus, in the convalescence from measles and whooping-cough it is very important that the child should not be exposed to the cold, particularly at night, when the temperature of the room naturally falls. In a nocturnal visit to the nursery—sometimes, too, I am sorry to say, to a children's hospital—how often one sees children almost naked, having kicked aside the bedclothes and having the night-clothes up about the arms."

In my practice I have all such children, while tossing about struggling for breath, and thus exposing themselves, put into bags of canton flannel, drawn about the neck, so as to prevent them from exposing the skin to the cold air.



CHAPTER II

SIGNIFICANCE OF SOME IMPORTANT SYMPTOMS

THE first duty of a physician is to recognize the actual condition of his patient. This may involve more than the diagnosis of any special malady which he may have, because the accompanying conditions vary indefinitely in different persons whatever the name of the disease. It may be the accompanying conditions which chiefly determine the nature of the prognosis, whether it be favorable or unfavorable, along with the leading indications for treatment. In other words, the more comprehensive the diagnosis be, the better.

On this account certain common but important symptoms of disease assume an interest quite their own, sufficient to warrant their being made the subjects of separate study. Each of these symptoms when present constitutes in itself practical information about the patient worthy of the completest investigation until all its possible bearings are determined. Not infrequently such consideration leads to conclusions of as great clinical importance as any questions about pathology or etiology, besides suggesting many a clue to correct diagnosis.

THE SIGNIFICANCE OF PAIN

We begin with the subject of pain as a good illustration of the advantage which the particular study of a single symptom may afford. In diagnostic value alone it is not to be surpassed by any of the common symptoms of disease, enough to warrant, whenever pain is mentioned by a patient, the postponement of all other questions until both its nature and its significance are clearly recognized.

The investigation should begin with a request that the patient show just where the pain is felt most, and where it first began. While he is doing so, the gestures which he uses should be carefully noted, as they often afford truer indications than his language does, because verbal descriptions of pain may be extremely indefinite. As a rule, such gestures are characteristic enough to aid materially in the recognition of the particular variety of pain, if not also of the nature of the affection itself which is present, as the following examples will show.

When the pain is due to inflammation, if external, as with a joint,

the patient will avoid touching the most painful part, or he approaches it in a very respectful way. Thus, with an arthritis his hand passes over the joint in a hovering fashion. If deeper seated, the gestures are often expressive of the varying kinds and distribution of the pain, according to the texture inflamed. Thus, the diffused soreness of a mucous-membrane inflammation causes the gesture of bronchitis to be made with the whole hand laid on the sternum, and then passed over and across the chest. A similar movement of the hand across the abdomen never means a peritonitis, but a catarrhal intestinal inflammation. With pleurisy, on the other hand, the tips of the straightened fingers are used to indicate the stabbing nature of the pain. In peritonitis, also, the tips of the fingers are used, but brought down with more caution than in pleurisy. In the localized pain of commencing appendicitis, the open hand is used, as with an inflamed joint. In pleurodynia, the whole hand is pressed firmly to the side, to prevent movement of the ribs. In rheumatic fever, the pointing by the patient to the epigastrium or to the xiphoid cartilage, especially if followed by a movement from the precordium upward or into the left arm, is significant of cardiac inflammation. So also the gesture in gastritis, whether acute or chronic, is wholly different from that in colic. Inflammatory pains about the head may have very characteristic gestures. The use of one finger-tip to localize it on the scalp is strongly significant of intracranial syphilis. The finger-tips passing up the side of the face and stopping on the scalp an inch below the sagittal suture indicates a pain ascending from a tooth, and should not be mistaken for a trigeminal neuralgia. In conjunctivitis, the hand is laid over the eye. In iritis, the finger is pointed toward it, not touching it, and then passed up the forehead to the inner side of the nose or to the malar process. In glaucoma, the gesture may be reversed, as if the pain were emerging from the orbit. All these gestures differ entirely from those of head-pains not inflammatory. Meningitis, whether cerebral or spinal, is significantly indicated by absence or suppression of gesture, for reasons to be noted further on. The exceptions to this are in some cases of tubercular meningitis. But the gesture of myelitis, with both hands passed from the back across the abdomen, to describe the cord or band-like sense of constriction, is almost itself pathognomonic.

On the other hand, the gestures indicating the seat of the greatest pain produced by pressure, as by tumors, abscesses, etc., or cramps, markedly contrast with those of inflammatory pains in showing no apprehension in touching or moving the part. Here the locality in-

licated at first by the gesture is of importance to note, and whether, on repeating the question, the same place is again started from, because the patient's hand then moves in a fashion expressive of the extension or radiation of the pain from the original focus, although he may describe the pain as equally present at some distance from the spot first pointed out. Hence, his unconsciously repeating the sign with which he commenced is of much significance. Thus, a patient with a growth springing from the lumbar vertebræ always first pressed the point of two fingers deeply into the abdomen below the umbilicus, while the fingers of the other hand moved over the sacrum, where he insisted that his pain chiefly was. A fixed pain in the back, caused by an aneurysm, is often indicated by the extended thumb, and likewise the pain preceding herpes zoster; but no spinal inflammatory pain will elicit such a gesture, nor will the pains of so-called spinal irritation.

In stretching pains, such as in biliary or renal colic or cramps, as in lead-colic, the contrast to inflammatory pains is shown by the forcible grasp or pressure which the patient makes on the abdomen, while the characteristic radiations of the different varieties may be very plainly represented. Even when the pain has ceased, the gestures descriptive of what he had experienced may be equally conclusive as to their nature.

The gestures expressive of simple neuralgic pains contrast throughout with those of inflammatory pains. A functional occipital headache is shown by a friction-like movement of the hand from the neck up, sometimes followed by pressure on the eyes with the fingers. So the hands are used with the firmest pressure in temporal or frontal neuralgias, or the patient may tightly tie a handkerchief around the head. This proneness to grasp or to press as well as to move the aching part is characteristic of neuralgic pains everywhere in the body. The gestures are also valuable from their indicating the shifting character of neuralgic pains, enough, at least, to distinguish them from the more fixed pressure-pains of tumors. Special characters of neuralgic pains are frequently described by the gestures, as in the darting pains of tabes.

Subjective pains, as in hysteria, are very characteristic, in their being more numerous and varied than true objective pains can be, and, secondly, in the inconsistency of the gestures with the often highly wrought description of them by the patient. Both the language and the manner of the patient is more like one telling the tale of a woeful past experience than of a present reality.

I might multiply many illustrations of the clinical value of gestures descriptive of pain toward making a right beginning in diagnosis. I have already implied, however, that pains differ much in kind and in character, and hence the necessity of distinguishing their special varieties. For this purpose I would classify them into six different forms, as follows:

(1) Pains due to inflammation; (2) pains due to pressure; (3) pains due to stretching; (4) neuralgic pains; (5) subjective pains; (6) cutaneous reflex pains.

Inflammatory pains have three great characteristics. The first is, that pain is elicited by pressure upon, or by handling, the inflamed part, and the rule is that pressure produces the maximum amount of pain at the seat of the inflammation. This fact is useful in diagnosis, both positively and negatively.

Thus, an inflammatory pain in the leg may be due to peripheral neuritis, to sciatica, to hip-joint disease, to gouty arthritis, to rheumatic arthritis, to muscular rheumatism, or to spinal meningitis, and each one of these may be distinguished from the others by appropriate palpation. In peripheral neuritis, pain is most complained of on pressure upon the skin and superficial structures much more than when you lift the whole limb in your hands or move its joints. Sciatica is diagnosed by the special tenderness on pressure at the sciatic notch, along the course of the nerve down the back of the thigh, or deep in the popliteal space, or between the heads of the soleus in the calf; hip-joint disease, by pressing the head of the bone against the acetabulum. I have shown¹ that a gouty arthritis may be distinguished from a rheumatic arthritis by the different points of tenderness about most of the joints in these two diseases. In gout the tenderness is distinctly most pronounced at the condyles; in rheumatism, along the tendons and at their insertions, and not on the condyles. Thus, at the knees, in acute gout, the condyles are very painful on pressure compared with the rest of the joint, while in rheumatism the pain is usually most elicited by pressure on the tendon of the quadriceps above and below the patella and on the tendons of the hamstring muscles. This same difference between these two affections in the points of tenderness is also well shown in the fingers. The pain of muscular rheumatism in the leg is shown by pressure or manipulation of the muscles themselves, and this serves to distinguish it from pains in the leg in spinal meningitis, where you may manipulate the muscles without pain, but you cannot move the whole leg without making the patient cry out

¹ Transactions of the Association of American Physicians, Washington, 1896.

or, if comatose, groan from the pain so caused. On the other hand, a child may complain of severe pain on the inner aspect of the knee, but you press the part and it does not increase the pain, which shows that the seat of the inflammation is not there, but by proper manipulation may be found higher up—at the hip-joint. Similarly, a child may complain of constant pain in the stomach, and I have known such a case thoroughly dosed for worms, but tenderness on pressure at the eighth dorsal vertebra showed that it had incipient Pott's disease.

Careful manipulation to locate tenderness will frequently reveal the nature of a trouble which otherwise may be obscure. Tenderness on pressure along the course of an intercostal nerve may dispose of a diagnosis of heart disease or, as I have twice known, of cancer of the liver.

So tenderness on pressure, rightly located, may indicate the presence of a hepatic or of a renal calculus. In the former case, if the calculus is in the cystic duct, most pain is elicited by pressing the tip of the index-finger deeply down at a spot $1\frac{1}{2}$ inches to the right, and a little below the umbilical line; if it be in the common duct, the pain is most pronounced on pressure at the base of the right arch of the ribs. In renal calculus, standing behind the patient, first place the thumbs of both hands under the last ribs, and then so spread the fingers over the abdomen that when the patient relaxes the abdominal walls by bending well down you can push the kidneys up toward the spine; then, as he straightens up, press the thumbs in strongly, whereupon, if he has a renal calculus, he will quickly bend over on that side. You may further confirm the diagnosis of a hepatic or renal calculus by putting one pole of a faradic battery on the spine, and then suddenly applying the other with firm pressure at the places just indicated, when you will distinctly elicit the same kind of pain which manipulation does. In appendicitis, much is made of the special tenderness elicited by pressure at what is called McBurney's point, on a line midway between the anterior spine of the ileum and the umbilicus.

The second great characteristic of inflammatory pain is that it is increased by any form of movement of the inflamed part, not excepting its own proper functional movements. The inflamed part, therefore, is both voluntarily and involuntarily kept at rest as much as possible. This is done by muscular action, the afferent impression of this pain being reflected to all the associated muscles of the part to restrain their action, and even to muscles which, though not usually connected with the function of the part inflamed, yet may disturb it

by their movements. Examples of the first kind are seen in the fixity of joints by the contraction of their muscles whenever and as long as the joints are inflamed, while the latter is shown by both the local or general rigidity of the abdominal muscles, according to the local or general state of inflammation underneath. You can exclude gastritis as the cause of stomach symptoms if there be no rigidity in the epigastrium. In appendicitis, from the commencement of the irritation the muscular resistance over the cecum may have the feel of a solid tumor much before there has been time for exudation or pus formation. A number of other characteristic signs are thus developed which point both to the existence of inflammation and to its seat. There is no part of the body, for example, so often moved for purposes of attention or expression as the head. When, therefore, on approaching a patient's bed, you notice that he turns his eyes, but not his head as well, to look at you, the reason may soon be found in rigidity of the muscles of the neck, owing to meningitis. It is a good sign of improvement in such a case when his head acts naturally with his eyes or nods in assent. A healthy child constantly bends or unbends its back, but a child carefully picking up something from the floor by bending its knees without bending its back should lead you to examine it for vertebral disease. There may be lameness from either arthritis or sciatica in the leg, but the muscular actions are characteristically different in each of these inflammations. I need not say how the movements of the ribs in breathing are watched by us for the same reason in examining for phthisis, pleurisy, or pleurodynia. Hence, the muscular accompaniments, so to speak, of inflammatory pain are of much service in diagnosis, because all the other varieties of pain except those of cramp have nothing to do with the muscles. In some cases of hysteric muscular contractions there may be much complaint of pain; but the other features of these cases enable us readily to distinguish them from inflammatory rigidity.

The third great characteristic of inflammatory pain is that it is accompanied by disturbance of the normal function of the affected part. Now this does not happen with the other varieties of pain, at least as a characteristic of them. Neuralgic headache, for example, is not accompanied by delirium or, ordinarily, by intolerance of light or sound, as the headache of meningitis is. Neuralgic pains in the spine, in the arms, or in the legs do not, like inflammatory pains, produce stiffness nor fetter the movements of those parts, whose chief functions are to execute movements. So the diagnosis between pleurisy and pleurodynia lies in the fact that the pain on movement of

the ribs in pleurisy causes the functional symptom of cough, while that of pleurodynia does not, for the seat of the pain is there, not in the pleura. Again, when a pain in the chest is accompanied by an altered ratio between the frequency of the respiration and the frequency of the pulse, we have strong reason, from this significant disturbance of a lung function, to suspect pneumonia. If inflammation of the heart or of the pericardium causes pain, it is always accompanied by signs of disturbed heart action. So gastritis cannot cause pain without being accompanied by symptoms of gastric functional disorder. The same is true of peritonitis, enteritis, or dysentery. I once wondered why a patient who complained of attacks of severe pain just above the pubis had been twice sounded by surgeons for stone in the bladder, when he showed no signs of disturbed function in the bladder whatever. It proved to be due to chronic lead-poisoning from the prolonged use of a hair-dye.

Besides these three great characteristics of inflammatory pains, the sensation itself often varies in kind, according to the tissue involved. The rule is, the softer the texture, the less acute the pain; so that it may be described as only dull and heavy, as in inflammation of the liver or in a pneumonia which has not involved the pleura. In inflammations of mucous membranes the pain, if moderate in degree, is more like a diffused soreness; if severe, it may be termed "burning." Whenever griping or bearing-down sensations develop it is because the inflammatory irritation has extended from the mucous membrane to the muscular coat of the wall of the canal or viscus which the membrane lines. Pain of inflamed serous membranes is much more acute than in the case of mucous membranes, and is apt to be lancinating or stabbing, as indicated by the patient's gesture. Pain of inflamed fibrous tissues, such as muscular fascia, nerve-sheaths, peritoneum, dura mater, etc., if moderate, is of a dull aching character; but if severe, is very violent, on account of the unyielding nature of the tissue. A serviceable indication of the seat of the inflammatory process is afforded by the susceptibility of patients with any form of fibrous-tissue inflammation to changes in the weather. In health there is a perfect adjustment between the centrifugal pressure of the circulation and the centripetal pressure of the weight of the atmosphere. Changes in the latter, as indicated by the fall in the barometer on the approach of a storm, are readily compensated for by the nerve-fibrils being readily removed in the softer tissues from unbalanced intravascular pressure, but not so in the denser fibrous tissues. Hence the good but inconvenient barometers which a gouty man has

in his toes, which may ache worse while the sky is yet clear, but which he knows, from experience, means that the clouds are on their way. So a patient with sciatica finds his bed-covering no protection when his leg wakes him in the middle of the night with its observations on the weather out of doors. It is well, therefore, to ask whether a headache complained of grows worse just before a storm, when you have reason to suspect that it is no mere functional trouble, but a cephalalgia of syphilitic origin, or from some other cause of pachymeningitis.

Inflammatory pain is peculiarly local and, therefore, referred to the part inflamed, except when the inflammatory process involves the course of nerves. In that case, it may be radiated either along those nerves directly or to some region in nervous association with the seat of the inflammation. Thus, the pain in ulcerative gastritis is often radiated to the sixth or seventh dorsal vertebræ. Inflammation involving the convex surface of the liver affects the distribution of the right phrenic nerve on the under surface of the diaphragm, and from there may radiate to the top of the right shoulder or between the scapulæ. Inflammation of the vertebræ sends pain to the anterior distribution of the surface nerves. Inflammation of the kidney radiates pain to the testicle and down the inside of the thigh, while inflammation of the fundus of the bladder produces pain felt in the head of the penis. In some cases of inflammation of the prostate pain is felt in the sole of the foot. In every case, however, these pains can be proved not to belong to the region to which they are referred by the fact that the patient has no objection either to movement or pressure of the part.

The *treatment of inflammatory pains* is that of the inflammation itself, and hence often different from, if not the reverse of, the treatment of other kinds of pain. The first indication is rest, including the position which assures most rest. After a rheumatic carditis the patient had better stay three or four months in bed if he still has cardiac pains and quickened pulse. Nothing is more serviceable sometimes in the later stages of pleurisy than to limit as much as possible the movements of the ribs by firmly strapping the whole affected side of the chest. But the instances in which this principle can be applied are too numerous to mention here. In many acute inflammations the vascular sedative action of topical bloodletting is often remarkably effective in relieving the pain. On the other hand, with the pains of chronic inflammations, the stimulant effect of counterirritation is preferable, according to the rule that the indications in the

treatment of chronic inflammations are the opposite of those for acute inflammations. In traumatic lesions, both the pain and the inflammation are generally treated best by the local application of ice-bags, but cold is useless when the inflammation is due to a general cause in the blood, as in rheumatic and gouty arthritis. Cold applications should be discontinued at once if they cause a neuralgic pain to take the place of an inflammatory pain. Many internal inflammatory pains are best relieved by the sedative properties of moist heat applied to the surface, as by poultices, etc., according to the general law that the cutaneous sensory nerves are always in association with the vascular nerves of the parts underneath. The chief drug for inflammatory pains is opium. Next comes aconite, especially in serous membrane and cardiac inflammations. The coal-tar analgesics, so valuable in the other kinds of pain, are comparatively useless in inflammatory pains.

Pressure-pains, as their name implies, are due to the encroachment of tumors, abscesses, aneurysms, or other causes of direct pressure brought to bear upon nerves anywhere along their course. Their chief characteristic is that they are essentially continuous. Though these pains may be aggravated into paroxysms of greater or less severity, yet they differ altogether from the large class of neuralgic pains with which they may be confounded by the fact that they never wholly intermit. There always is some uneasiness left at the seat of pressure, however much the pain has lessened in degree. The reason why they are mistaken for neuralgic pains is because they do not show the character of inflammatory pains in being increased by pressure or movement, or by producing muscular stiffness, except sometimes abdominal rigidity in the case of gastric or pancreatic tumors. We always, indeed, have reason to suspect that a fixed or stationary pain is something more than functional, and most likely due to an organic mischief, however hidden that may be. On the other hand, pressure-pains may present a seeming resemblance to inflammatory pains when the pressure mechanically interferes with the function of the parts or organs implicated. Thus, in brain tumors or abscesses the small room in the cranial cavity for any displacement may cause many symptoms of functional disorder of the brain to accompany a pressure-pain there. Except in the case of brain abscess, however, the absence of fever and of other accompaniments of inflammation will ordinarily suffice to indicate the true nature of the pain. In other parts of the body the disturbance of function caused by pressure is different from that caused by inflammation, in that the func-

tion is embarrassed, rather than excited, while the pains are evidently not so closely connected with the functional actions themselves as they are in inflammation.

Pressure-pains are apt to radiate more widely than any other kinds of pain when the pressure involves large trunks or plexuses of nerves. They differ in such cases from radiated inflammatory pains in their greater variety of range. But, however far they may travel, they are always characterized by having a central focus or headquarters where pain is never absent and to which they can be traced. A careful examination then will show that, whereas pain is constant at the original focus, those which radiate from it, though they may seem much more severe, are quite subject to variations. Thus, years ago a phthisical patient of mine began to have agonizing pains in his legs, which he very distinctly referred to both sciatics. At first I was deceived into treating him for sciatica by vigorous local measures, including the actual cautery. In time I found that his sciatic pains were too paroxysmal and shooting in character to correspond to local neuritis, and, moreover, that the characteristic tenderness on pressure along the course of these nerves if inflamed was not, in him, at all well defined. Meantime he had a fixed pain in the back just above the lumbar vertebræ, nothing like as severe as in the legs, but nevertheless both uniform and persistent. Months passed, and then the development of a soft swelling, divided by Poupart's ligament in his right groin, explained everything as due to the progress of a psoas abscess. I have always since searched for the abiding places of pain, no matter what its excursions might be.

When a tumor involves in its growth the trunk of a nerve, it sometimes causes trophic changes at the peripheral distribution of the nerve on the skin, in the form of an intractable ulcer or as a herpetic eruption, followed by persistent local anesthesia.

Painful cramps are a variety of pressure-pains. The cramps are generally of reflex origin, and when persistent the tonic contraction causes much wasting of the implicated muscles. We have in the persevering use of the warm-water douche a specific remedy for both this pain and the muscular contraction which causes it. Pressure-pains in general are much less under the control of opium than inflammatory pains. The pains soon get used, as it were, to the opium, and we have to increase the dose to get the desired effect. On the other hand, antipyrin, phenacetin, and the other coal-tar derivatives, given with spirits of aromatic ammonia, are often of considerable service. This is especially true in pains caused by aneurysms.

Stretching Pains.—The peculiarities of stretching pains are well illustrated during the passage of a calculus through the bile-duct or the ureter; also in severe sprains. More than any other pains, they, when severe, cause great faintness, nausea and vomiting, often with chills and cold sweats. Unlike either inflammatory or pressure-pains, their onset is usually sudden, and in the stretching of narrow ducts painful spasms in them so commonly develop that the attacks have a pronounced paroxysmal character, whence the name "colics" is derived. The sufferers show plainly enough by doubling themselves upon the affected part or by firmly pressing their hands over it that the pains are not inflammatory. Meantime the characteristic radiations of the pains are of much diagnostic value in distinguishing either hepatic or renal colics from each other and from other painful affections in the abdomen, being in the hepatic variety from near the umbilicus directly through to the back and upward between the scapulæ, and in the renal from the back down to the groin, with retraction of the testicle, and radiated also to the inner aspect of the thigh. In sprains, at the onset there occurs a marked superficial tenderness of the skin, which, however, passes off in a few hours, but which may serve, at the ankle, for instance, to show that the injury is a sprain rather than a fracture. The pains of so-called myalgia, so common in women with feeble muscular development, felt at the attachments of the abdominal muscles to the ribs or along the attachments of the erectors of the spine, are virtually stretching pains due to an undue pull upon tendinous textures from deficient muscular support. Cutaneous hyperesthesia, therefore, is very common at the places where the pains are most felt, and the patients often complain of the wearing or exhausting nature of these pains, which, moreover, show that they are not properly neuralgic, from their having no tendency to shift. In the treatment of biliary or renal colics the first indication is to prevent the spasms which induce the paroxysms of pain and, moreover, hinder the onward passage of the calculus. This is best done by arresting the afferent impression of pain which evokes the motor effect of spasm, and we have nothing like a hypodermic of morphin, with atropin, for accomplishing this purpose. Next follows the excitomotor paralyzer, warm water. In biliary and renal colics the sudden cessation of pain generally indicates that the calculus has passed out of the duct, and hence is much more reassuring than sudden cessation of a severe inflammatory pain, for that may mean that gangrene has supervened. Sprains are best treated by douches—of hot water when acute; of cold, when chronic. Local applications of belladonna

or of stramonium ointments or liniments, with the addition of chloral, may relieve better than the lead-and-opium lotion so useful in inflammations. For the same reason belladonna plasters are beneficial in spinal myalgia. In myalgia, however, the first indication is to develop and strengthen the muscles by massage, or by alternate exercise and rest, combined with the great restorer of weakened muscles, the oxygen of the open air.

Neuralgic Pains.—There is no term which needs definition more than that of "neuralgia." Etymologically, it may apply to any pain in a nerve, and hence we find it given to the most diverse kinds, from *tic douloureux* to the pains caused by tumors. It ought to be cleared of all such vagueness of meaning, because true neuralgic pains have a wholly different causation from either inflammatory, pressure-, or stretching pains, and hence demand different treatment. Thus, in the first place, they present none of the signs of inflammation, no rise of temperature, no swelling or local infiltration, no objection to pressure, but the reverse; likewise, none to movement, but often here also the reverse, and they are not accompanied by any characteristic disturbance of function in the parts which they affect. On this account it is erroneous to include among neuralgias a whole group of inflammatory conditions of nerves or nerve ganglia, such as typical *tic douloureux* or so-called trigeminal neuralgia, in which the different branches of the trigeminus, and often the gasserian ganglion itself, are the seats of intense and disorganizing inflammation.

In this affection—namely, trigeminal neuralgia—the paroxysms of pain are particularly excited by the functional movements of the facial muscles, such as in chewing, opening the mouth for speaking, or even by the movements of facial expression or emotion, etc. Moreover, whenever the affected branches of the trigeminus are superficial enough for us to press upon them we find them exquisitely tender, as at Valleix's points. The same may be said of most cases of so-called brachial neuralgia, where the arm has to be kept as still as the leg in sciatica to prevent the paroxysms of pain. Likewise, most cases of "cervico-occipital neuralgia" are really cases of neuritis, and should be treated accordingly.

Unlike inflammatory, pressure-, or stretching pains, true neuralgic pains are much less local, and many of them are prone to wander about. This feature alone may serve to demonstrate their nature, for frequently they shift their seat altogether, wholly disappearing from one locality, to develop with just the same symptoms and severity in quite another part. In this respect they are readily distinguishable

from the pains which radiate from an inflammatory or pressure focus. One notable distinction of neuralgic pains, however, lies in the significant fact of intermittency. Neither an inflammatory, nor a pressure-, nor a stretching pain can intermit; they can only remit or else cease with the cessation of their cause. Neuralgic pains, on the other hand, come and then go entirely, leaving the patients as free from them, temporarily at least, as if they had never experienced them. No one, for example, can foretell that the vivacious lady whom he meets in company will be entirely prostrated the next day with a severe headache, and then two days afterward be as free from it as ever. This fact about many neuralgias is very suggestive of their toxic origin, for it is only in chronic toxemia that we have similar cumulative results leading to nervous explosions, so to speak; as, for instance, uremic convulsions or attacks of gouty asthma.

We would divide neuralgic pains into the febrile toxic and the non-febrile toxic. Examples of the first are found in the aches produced by the poisons which cause fever. Frontal headache, lasting for more than twenty-four hours and accompanied by a rise of temperature, with a general aching in the back and limbs, should lead us at once to suspect a febrile connection. If it lasts three days or more it must be due to such a cause. These pains are in no sense inflammatory, for they cause great restlessness, the patients tossing about in bed on their account and not on account of the fever. Though in most specific fevers these headaches last longer than most neuralgiac pains, yet they always cease before the fever ceases. The best medicinal remedies for them are phenacetin with ammonium bromid, or, in epidemic influenza, phenacetin with aconite, and a small dose (1 gr.) of Dover's powder. Cold applications to the aching head are often very grateful.

The second class of toxic neuralgias are the non-febrile, of which a good example is found in the truly periodic neuralgias, or those which come on at definite times of the twenty-four hours, and then subside like an attack of ague. It is natural, therefore, to surmise that they have some connection with malarial infection, but in many cases this is not plainly demonstrable, and, moreover, notwithstanding they may be very severe, they most commonly are not accompanied by rise of temperature. Some severe examples of this kind I have found occurring from influenzal infection. They may attack the head, the sides of the chest or abdomen, or be located along the spine or in the pelvis. I have not met with more violent cases of pain than in some of these patients, whom I have seen both in my own practice and frequently

in consultation. In the latter cases I have learned that quinin, Warburg's tincture, arsenic, and the coal-tar analgesics had been previously administered, often in heroic doses, without any effect toward preventing or mitigating the attacks, and hence I am glad to say that I consider ergot in full doses to be a true specific for periodic neuralgias, whatever their seat be. A dram of the fluidextract should be taken every two hours, with a dram of elixir of cinchona in water, to prevent nausea. If the stomach does not tolerate the ergot, it may be administered per rectum in 2 oz. of water. The first dose should be taken at the very beginning of the onset of the pain, and if that suffices to arrest it a second dose is not needed, but with some it requires three doses. It is curious that in many cases I have found that 12 gr. of quinin will cinchonize patients who have just taken ergot, when doses of 30 gr. taken before had not done so.

Migrainous headaches are essentially toxic in their origin and due to perversions in gastro-intestinal digestion, causing absorption into the blood therefrom of poisons which at a certain point of accumulation bring on the attack. Like gouty or lithemic derangements, they are very commonly due to constitutional or hereditary tendencies. Ergot is here also a specific for the attacks themselves, administered as above recommended for periodic neuralgias, but in many cases we may succeed as well with 10 or 15 gr. of antipyrin and a teaspoonful of aromatic spirits of ammonia, taken early with the first symptoms, when the patient should at once lie down, and then repeat the dose in two hours if required. But the true treatment of migraine is prophylactic, by a prolonged and systematic course of intestinal antiseptics.

Patients with a persistent rapid action of the heart, without fever and without cardiac or renal disease to account for the tachycardia, are very commonly great sufferers from neuralgic pains in the various parts of the body. This is well shown in many cases of Graves' disease, both before and after the development of thyroid symptoms, but such neuralgias may be equally present in patients with such tachycardia who never show either exophthalmia or goiter. Here intestinal antiseptics, such as weekly mercurial purgation, perseveringly followed up by phenol or naphthol bismuth, bismuth salicylate, strontium salicylate, salol, etc., and total abstinence from butcher meat, taking milk instead, will cure both the neuralgias and the overaction of the heart.

Gastric acidity is apt to produce frontal and temporal headaches, while occipital headaches, accompanied by tenderness on pressure upon the eyeballs, are distinctive of intestinal fermentation. In some cases severe attacks from like causes take place in the stomach, which go by

the name of gastralgia. The relief following upon the administration of $\frac{1}{4}$ -gr. doses of arsenous acid in gastralgia would seem to indicate its causation, for arsenic very quickly arrests any form of fermentation.

Under the head of non-febrile toxic neuralgias would come those occasioned by chronic metallic poisoning, especially that by lead, in which wandering pains occur which are apt to be mistaken for rheumatism, though undoubtedly they have more relationship to gouty neuralgias, as lead-poisoning is one of the recognized causes of the gouty state. On the other hand, the abdominal cramps are just as specific effects of plumbism as its special paralyses are. Lastly, among these non-febrile toxic neuralgias we should not forget those due to Bright's disease and to diabetes. Pain in the back of the head is common in Bright's disease, and is not necessarily of dangerous import. Not so, however, when general pains are complained of in every part of the body, for these may presage a near fatal issue, as their frequent association with convulsions shows. On the other hand, the local pains occurring in diabetes not infrequently are due to actual neuritis.

The third class of neuralgic pains are the non-toxic. They sometimes appear to be purely reflex, as, for example, a true trigeminal neuralgia caused by a necrosed piece of bone in the nares, and which is cured by its removal. Under this class also come headaches from eye-strain, about which we hear so much. Of one peculiar form of headache I have met several instances. The ache seems to begin at the root of the nose, and passes horizontally backward to the occiput. It is always aggravated by prolonged bending forward of the head, as in writing, etc., and has a special tendency to cause incapacity for mental exertion. In each of my cases it was found associated with a nasal obstruction from old fractures of the nasal bones, and the headaches were cured by operation.

One important form of neuralgic pains of a non-toxic character is that due to a degenerative process set up in sensory nerves and nerve-roots, such as the lightning pains of tabes. The degenerative processes themselves may have been due originally to a toxic infection, such as syphilis, but this no longer operates as a cause of the pain. The patients rub, seize, or grab the affected part as if they were desperately bent on arresting the pain in its flight. For the pains of tabes the coal-tar analgesics are often very effective, particularly acetanilid. Nitrate of silver also often affords decided relief, and it is curious that this drug will sometimes unmistakably mitigate pressure-pains caused by a tumor involving the roots of a spinal nerve, as I have had occasion to note in several instances.

I surmise also that the rapidly fatal form of angina pectoris is likewise due to degenerative disease of the intrinsic cardiac nerves. Some writers seem inclined to merge this most specific disease of angina pectoris into a mere general symptom, and to confound with it all forms of cardiac pains not due to inflammatory processes. Thus, the paroxysmal anginose pains in a case of combined aortic stenosis and incompetence are pronounced indistinguishable from those of angina pectoris. Let the mitral valve, however, begin to leak also in these cases, and so relieve the intraventricular pressure, and the pains vanish altogether. I cannot but regard them, therefore, as wholly analogous to the cardiac pains in patients with general arteriosclerosis and high-tension pulse, and which are brought on by overwork of the heart muscle, just as cramps may be induced in the calves of the legs by too prolonged dancing. But the clinical histories of typically fatal attacks of angina pectoris are totally different. Thus, one of my patients, who had never experienced a single symptom of heart trouble before, was suddenly attacked on waking in the morning, while resting quietly in bed, with the first pang, which so terrified her with a sense of impending death that she sent for me. I saw her three hours afterward, when she was quite free from pain, and when she gave me a most intelligent account of it. I advised her to remain in bed and left a prescription for amyl nitrate, to use in case of a return of the pain. Ten minutes afterward she suddenly died. Another was a gentleman who, without any previous warning, was first seized with a short paroxysm while talking to a friend. I saw him soon afterward, and his description of the attack left no doubt of its nature. Ten hours afterward he suddenly died.

One of the striking accompaniments of this fatal pain is an instructive apprehension on the part of the patient of impending death, one gentleman of my acquaintance remarking that he did not know that death could be so painful, and a moment afterward he breathed his last.

Neuralgic pains in different parts of the body are very characteristic of impoverishment or anemic states of the blood, one author remarking that neuralgia is the cry of a nerve for more or better blood. But while neuralgias are very common in anemic states, yet they are not always characteristic of them.

Thus, I have met with instances of pernicious anemia in which there was no neuralgia complained of from the beginning to the fatal end of the disease. On the other hand, blood impoverishment is often the direct result of the toxemias, which also cause toxic neuralgias, and

hence I would paraphrase the saying that "neuralgia is the cry of a nerve for more blood" into a "cry for purer blood." Iron, cod-liver oil, etc., are good remedies in these cases by improving that general nutrition, which is Nature's most effective antiseptic.

Subjective Pains.—In a sense, all pains are subjective, for if by severing the nerves we interrupt the conduction to the sensorium of the severest inflammatory or pressure-pain, there will then be felt no pain at all. But as the sensation of pain itself is a centric function, why may its origin not be in a disturbance of the pain centers themselves without an antecedent peripheric irritation? Certainly we must admit that, for example, in many cases of hysteric hemi-anesthesia this sensory derangement evidently starts from a cortical area, but if so, then a hyperesthesia amounting to severe pain is just as likely to own a similar origin. I have no doubt that this is sometimes the case also in patients who cannot properly be termed hysteric, but who are said to have a highly nervous organization, and in whom some violent attacks of pain are brought on by strong emotion. The cerebral relations of these pains, however, make them so likely to be influenced by purely cerebral states, being often both induced and removed by mental impressions alone, that we are apt to regard them as more or less imaginary. This, however, is a less common mistake now than formerly, as the pathology of hysteria itself is becoming better understood. A motor paralysis of hysteric origin is as real as any other paralysis, as in the case of a motionless vocal chord in hysteric aphonia, where, of course, the patient knows nothing about the paralyzed part which he has never seen. Likewise, hysteric pains may be as unimaginary as such motor derangements are. Owing, however, to their cerebral origin, they are far more intimately associated with mental or emotional states than is possible with any other class of pains. The patients think them, so to speak, as much, if not more, than they feel them, and so are often led to refer them to any part of the body by simple mental suggestion or, what amounts to the same thing, forgetting one pain while their attention is directed to another. Hysteric pains, therefore, may simulate all varieties of pain, one after the other, in such succession that a beginner in practice may be much puzzled by them, especially when complained of about the joints or in the abdomen. Hence, a careful observation of the mental accompaniments of the pain is the surest way to arrive at the diagnosis of its hysteric nature. Thus, real objective pains are very concisely described with a few characteristic gestures and equally few words. Subjective pains, on the other hand, are described with

many a theatric gesture and with a copious variety of terms, which all go to show how much the patients occupy their minds with dwelling upon them. This of itself is enough to strengthen the presumption of their subjective character, for objective pains always inhibit both thought itself and its expression. The description of a lively disturbance in the great toe by gout is generally limited to interjections or expletives; while, on the contrary, the hysteric patient seems to enjoy talking about her unexampled sufferings by the hour, especially to a sympathetic listener. The treatment of hysteric pains is to be that of hysteria itself. Nothing is more useless or mischievous than to relieve them by anodynes and particularly by opiates.

Cutaneous Reflex Pains.—Dr. Henry Head, Registrar of the London Hospital, has directed the attention of the profession to a very interesting class of pains which are elicited by lightly pressing the skin or touching it with the head of a pin. Nothing, therefore, could be so extremely peripheral as these pains, but their interest lies in the fact that only deep-seated visceral disease will cause them. When these pains are produced by the light application of a large-sized pin's head, the patient not being allowed to see it done, they are complained of as a burning or smarting sensation, which when pronounced leads the patient to beg that the experiment be not repeated. I have myself repeatedly confirmed this curious phenomenon. Thus, a man with a calculus in the left kidney always swore when the pin's head touched the tip of the left twelfth rib. The special interest of Dr. Head's researches lies in his demonstration of the definite limitation of the cutaneous areas of these pains to the distribution on the skin of nerves associated with the nerves of the corresponding internal organs. This distribution is not according to the segmental distribution of the spinal nerves, but according to certain definite associations of nerves which are curiously illustrated by the eruptions of herpes zoster, which Dr. Head shows correspond to the different cutaneous areas of reflex hyperesthesia in organic visceral disease. Thus, I found in a patient with gastric ulcer these well-marked cutaneous pains over the ensiform cartilage, at the junction of the eighth rib with its cartilage, and in the back on a level with the angle of the scapula. Dr. Head has mapped out a most elaborate delineation of the areas on the skin, in which, if these pains are present, we may thus diagnose from what internal viscera they proceed, but we cannot more than allude to them here on account of the need of constant reference to his charts to illustrate the statements which he makes. In trying, however, to verify these observations myself, I have found that when these pains

are present in the specific localities which he describes, they afford very valuable indications, but their absence is no proof whatever of the absence of organic visceral disease. Thus, only about 1 out of 8 cases of undoubted ulcer of the stomach showed these painful skin symptoms, and then not unless the local pain in the stomach itself was well marked. Similarly, in heart disease, aortic aneurysm, and other internal affections the pain thus reaches the skin only when it first has been severe within. Nevertheless, it is a very suggestive subject and merits further investigation, not only for the aid which it may afford in the diagnosis of internal organic disease, but also in the relation of many pains about the head which have been classed as local neuralgias, but which may thus be shown to be associated with definite disturbances, sometimes functional as well as organic, in the thoracic and abdominal viscera.

THE SIGNIFICANCE OF EMACIATION

One of the general conditions which is at once recognized as an evidence of disease is emaciation. It is always a serious condition when present, even when we have reason to believe that it will soon be recovered from. It is usually described as a loss of flesh or that the patient has grown thin. But this is too partial a designation, because actual emaciation includes much more than loss of fat or even of muscle. To be thin, in the sense of having but little fat, may be quite compatible with good health in many persons, because on examination their muscles and bones are found both well developed and well nourished. True emaciation, on the other hand, is characterized by loss of bulk in every tissue of the body except one, and that an important exception from its practical bearings, as we shall see. As each tissue becomes involved in the wasting, special complications arise therefrom due to the emaciation itself, whatever its original cause may be. Clinically, therefore, emaciation sometimes may assume the character of a concomitant disease with important indications of its own for treatment; for not infrequently particular conditions accompanying emaciation become themselves grave, if not fatal, elements in the case.

The fact of emaciation is best revealed by the hands. The face, especially if not known to the physician before, may not suggest the general wasting present, but the appearance of the backs of the hands is unmistakable. Instead of a uniform and slightly convex surface, they show deep furrows between the metacarpal bones from atrophy of the interossei muscles. On extending the fingers, only the condyles touch each other. On the under surface the wasting of the palmar

muscles renders the natural concave shape of the bones so pronounced that, where extreme, the whole hand resembles the crooked claws of a bird.

There is no morbid condition in which a knowledge of its etiology is of such practical importance; but though cases of emaciation are very numerous, their usual causes are so few that they can be remembered readily when we would distinguish to which of them the condition is due. The ordinary causes of emaciation are six in number, as follows:

1. Bacterial infection.
2. Malignant diseases.
3. Gastro-intestinal disorders.
4. Jaundice and cirrhosis of the liver.
5. Diabetes.
6. Graves' disease.

Bacterial Infection.—Fully 75 per cent. of all cases of emaciation are owing to the direct solvent action of bacterial toxins upon the body cells. This property of these toxins is illustrated by the extreme emaciation following experimental injection in animals of various bacteria even in attenuated cultures if the injections be long continued. That no other agency can be operative in this instance is plain from the animals being in a healthy condition when the experiments are begun, and also by the fact that the emaciation will progress if the injections are kept up, though the animal has been rendered immune against the original infection, thus showing that the antitoxin generated is powerless against the wasting itself.

The most appreciable sign of this poisoning, but which occurs also in emaciation from other causes, is a general disappearance of fat. But this involves a loss of the great subcutaneous cushion of fat which is so necessary for the healthy condition and blood-supply of the skin and of its appendages. The skin thus loses its vitality and becomes readily infected by scratches or slight injuries, particularly if it be not kept scrupulously clean. Ere long another complication ensues by the bones coming in contact with the thinned skin until an intractable ulceration follows. Bed-sores are never trivial things, and repeatedly have I known them to become the cause of death. Hence in every case of wasting fever the patient's back should be examined twice daily and the first signs of redness over subjacent bones noted. Fever being a process which especially involves the muscular tissues, the patients are prone from muscular weakness to lie unchangeably on the back. In health, frequent shifting of posture is secured by the

normal intolerance of the surface nerves to too continued pressure, but in fever, blunted sensation is the rule, and unless watched any patient with a prolonged febrile disease is apt to develop ulceration there which may heal only with difficulty. The surest preventive of bed-sores, therefore, along with maintaining constant asepsis of the skin, is frequent change of position. Thus, serious examples of this trouble, though not due either to emaciation or to fever, are the bed-sores which accompany transverse myelitis so generally that many regard them as inevitable with this spinal lesion. But Dr. Starr ("Organic Nervous Diseases," p. 50) mentions the case of a patient of his in whom the simple expedient of turning him every half-hour day and night, and wiping off the skin lightly each time that he was turned, prevented for four years the development of any skin abrasion.

Another complication, giving rise to great distress to those who are confined to bed, especially with a chronic wasting disease, is the supervention of general neuralgic pains which interfere with both rest and sleep. The true cause of these pains is often not recognized, nor, therefore, how they best can be remedied. As remarked above, there is one tissue which does not emaciate, and that is nervous tissue. This is in keeping with the fact that in animals dying of starvation every tissue loses weight and bulk except the brain and spinal cord. In emaciation, therefore, the nerves are all there, but now no longer protected from the pressure of the bones by layers of fat and muscle. The most severe aching, wearing pains are thus kept up day and night. Hence I cannot too earnestly recommend some simple procedures which I have found to greatly mitigate these pains. I have long provided for emaciated phthisical patients sheep skins with the wool left on, procured from furriers, who often sew such skins together and dye them, to sell as fur robes. These should be spread on the bed, and with a sheet over them they make a soft, yielding support which retains its elasticity indefinitely. Similarly, a musk-ox fur robe so used afforded the utmost comfort to a patient wasting away with internal cancer. Where such articles cannot be readily obtained, the patient may be padded where necessary, especially between the condyles of the knees or at the scapula and sacrum, by layers of cotton batting, frequently changed or adjusted.

With the disappearance of fat, it will soon be noted that the muscles are losing bulk also. This muscular atrophy may be so marked that on lifting the arm, in a case of advanced phthisis, the large, rounded muscles of a mechanic may seem changed into the semblance of slender cords or flat ribbons. This change is the direct

result of the febrile processes which figure among the commonest results of infections. As the muscular tissues are the chief generators of animal heat, so fever is a muscular disorder, and enfeeblement of muscular function is its most invariable attendant. Hence what is apparent to the eye in the external muscles must coexist in all muscular structures within, and all the serious complications which that fact implies should be borne in mind. Thus, many of the gravest conditions in typhoid fever are due to a virtually emaciated heart, and as we shall mention in discussing the treatment of that disease, instead of trusting to cardiac stimulants, the means for preventing emaciation should be regarded as the surest resources against heart failure.

The same holds true of many other dangers of prolonged fevers. In tubular structures with muscular coats, venous congestion and loss of muscular tone go together. Hypostatic pneumonia depends upon filling up of the bronchi. The muscular walls of the stomach and bowels relax with gaseous distention, the bladder has to be emptied with a catheter, and involuntary discharges occur from the bowels, all chiefly effects of the same wasting and weakness illustrated by the condition of the heart. Hence one of the most important questions in the treatment of wasting fevers is how to feed the patient so as to prevent emaciation.

Some febrile infections, such as pneumonia or diphtheria, run too short a course for the loss of fat to be noticeable, though the heart may have been fatally weakened. It is in chronic infections, however, that the signs of emaciation may be of great significance for diagnosis. In them the bones may become thinned in a very characteristic way, as may be noted in the dread insidious infection of tuberculosis. Long before any physical signs are discoverable in the lungs the tuberculosis skeleton, so to speak, may be recognized. A recent pleural effusion is ominous if the shafts of the radius and ulna are much too slender. So perfectly characteristic is the contrast between the chests of two patients with a chronic cough, the one due to phthisis and the other to chronic bronchitis, that the diagnostic value of emaciation thus illustrated warrants a detail of those contrasts.

A glance at their bones and muscles suffices to show that these patients are suffering from conditions of disease entirely different in nature, although both have dyspnea, cough, and profuse expectoration.

In chronic bronchitis the thorax is large, rounded, and distended, with the clavicles raised; in phthisis, the chest is small and retracted and the clavicle sunken. The neck, therefore, differs in every respect,

being short and thick in bronchitis, with the chin drawn back, while in phthisis it is long and slender, with the chin carried so far forward that a vertical line from it would drop outside the umbilicus. In bronchitis the accessory muscles of respiration are wide and hypertrophied, causing the supraclavicular fossæ to be much deepened; in phthisis the neck muscles are flat and attenuated and the fossæ shallow or obliterated. In bronchitis the ribs are large and broad; in phthisis, small and narrow. In bronchitis the face is turgid, the ears thick, the eyelids swollen, and the conjunctivæ suffused. In phthisis the ears are thin and translucent, the cheeks retracted, with a characteristic drawn appearance from the platysma myoides being put on the stretch by the descent of the clavicles, while the conjunctivæ are so transparent that the eyeballs look glassy. All these features of emaciation in tuberculosis are serviceable for diagnosis when they sometimes long precede any notable change in the lungs. Latent tuberculosis is not uncommon, and should be suspected if the bones are emaciated.

Malignant diseases, whether carcinoma or sarcoma, but especially carcinoma, specifically cause emaciation irrespective of their seat. They naturally do so when they interfere directly with alimentation, as in cancerous stricture of the esophagus, but one of the extremest cases of emaciation which I remember was in a man whose normal weight was 190 pounds, but who at autopsy showed only a small cancerous tumor involving a sacral nerve, and a few enlarged lymph-glands with small scattered deposits in the liver, but all of the growths together hardly weighed 2 oz. Gastric cancer was regarded as particularly wasting because of the accompanying loss of peptic power from absence of free hydrochloric acid in the stomach secretion. It is now shown that free hydrochloric acid is equally absent from the gastric juice wherever the cancer is located, as in mammary or uterine cancer, so that this deficiency must be due to some general and profound change in the blood. From clinical facts we must conclude that cancerous growths continuously add virulent poisons to the blood from the time that they begin, the rule being that the slower the growth, the greater the emaciation, probably due to the bone-marrow becoming affected so that the blood-cells are greatly lessened in number and altered in shape, while the general metabolism also suffers as shown by the remarkable diminution of urea excreted by the kidneys. The patients, therefore, often early lose flesh and color much before any local development can be found, while the constitutional change is accompanied by a dinginess of the skin characteristic of the cancerous cachexia. Not infrequently, however, we have to make a provisional

diagnosis of hidden malignant disease chiefly because the emaciation cannot be accounted for otherwise.

Gastro-intestinal Disorders.—Some disorders of the gastro-intestinal tract are accompanied by emaciation and others are not, so that this symptom should be taken account of in differential diagnosis. The diseases of the stomach which cause emaciation may be either organic or functional. Of the organic affections, chronic gastric ulcer accompanied by pain and then by vomiting soon after eating may induce extreme wasting because the meal is rejected before it can become food. The aspect of the face in such cases is quite different from febrile emaciation, for there is no flush or injection of the skin, which instead is blanched with the temporal veins looking very blue by contrast on the white surface. This serves also to distinguish the condition from gastric cancer, in which the complexion is more opaque. Meantime the cheeks, instead of the drawn appearance in phthisis, are sunken in between the jaws, and the face frequently wears the expression of pain. Chronic gastritis without ulcer causes emaciation in some persons when, owing to loss of appetite and discomfort or pain after eating, they tend to eat so little that they become in time virtually starved. The same occurs in chronic gastritis after the gastric mucosa becomes so atrophied that both free and combined free HCl and pepsin and rennin are absent. This condition is particularly characterized by lancinating pains, and is further aggravated if the inflammatory process extends to the duodenum,

If the motor function of the stomach walls be impeded, the food may long remain in the stomach undigested, for in all cases of loss of motor power gastric secretion is seriously disturbed or ceases absolutely, when, from want of the antiseptic properties of the normal gastric juice, the stomach contents decompose and are finally vomited. The general nutrition often suffers in these patients. On the other hand, if the motor function remains, so that the gastric contents are discharged into the intestine, emaciation may not occur, for many cases of total absence of gastric secretions have been reported in patients whose body-weight has continued normal and their general health unimpaired because the intestinal digestion of the food may fully suffice (Hemmeter).

Functional disorders of the stomach which may cause emaciation are of nervous origin, as in those cases where there is total abolition of the nervous function of appetite along with persistent repugnance to food. Ordinary anorexia is of little account, as people usually manage to take enough food even when they do not crave it, but the anorexia

which leads to starvation is always an accompaniment of some serious neurosis. One curious form was named "anorexia nervosa" by Sir William Gull, and his clinical description of the affection I can fully confirm from my own experience. The patients are usually girls, who, after a varying period characterized by changes in or perversity of disposition, begin to manifest an obstinate aversion to food in any form, and continue to do so though threatened with utter starvation. Meantime they seem impelled constantly to move about and wear out their friends with the long walks which they insist on taking. Forced rest in bed and judicious feeding generally work a cure. Dangerous anorexia is also frequent in insanity, particularly in mania and in melancholia, so as to require forced feeding, but even this measure sometimes fails to arrest the rapid emaciation in acute cases.

A chronic, though not extreme form, of emaciation is worthy of mention because its cause is often not recognized. A very persistent and disabling anorexia occurs in women who have suffered from pelvic cellulitis, on account of the chronic irritation analogous to the reflex effects of pregnancy on the stomach and duodenum which is set up by old inflammatory exudations in those regions. It is remarkable how little nourishing food such patients eat in the course of the day. To such patients, acids, bitters, and other drugs, supposed to improve the appetite and to aid digestion, are often given in long succession without avail. Proper local treatment to remove the cause, with prolonged stay in the open air without exercise, as in a hammock, are more successful than drugs to restore appetite and nutrition.

Frequent or daily vomiting occurs in hysteria, but often without any accompanying emaciation, the explanation being that it is not food which is then ejected, but only fluids with small quantities of mucus.

A persistent gastric disturbance with recurrent attacks of greenish vomiting and progressive emaciation should always lead to examination of the urine for kidney disease. Emaciation from this cause often shows no signs of edema even in the face. The urine may contain but little albumin and not many casts, but the percentage of urea will be found continuously low.

Affections of the bowels producing loose or frequent movements vary a good deal in their proneness to cause emaciation according to the part of the intestine involved. Though modern writers seem disposed to deny the restriction of such affections to separate divisions of the intestinal tract, yet there are clinical differences between a

chronic enteritis and a chronic colitis which still justify the use of the terms "diarrhea" and "dysentery." In chronic diarrhea the commonest time of onset is the latter part of the night or early morning, when the patient has been resting quietly without taking food for hours. In dysentery the taking of a meal induces at once a desire for stool, and so does bodily exertion. In dysentery the pylorus seems to remain relaxed, and the food not only passes quickly through the stomach, but the peristalsis of the bowels started by that of the stomach is so active that patients may tell you that they can often detect in the dejecta the smell of the articles of food on which they had just dined. This never occurs in diarrhea. The worst results as far as emaciation is concerned may be noted in the dysentery of infants. The smallest quantity of milk swallowed brings on a movement in which the milk is seen to have passed quite undigested. The little patients thus become so starved that they look like old weazened mannikins.

The explanation of this difference between diarrhea and dysentery is to be found in the nervous relations between the stomach and the rectum. In health, the best time to have a natural evacuation of the bowels is after the meal which has been taken when the stomach has been longest empty, that is, in the morning. The rectum is in such reflex association with the stomach that it is excited to expel its contents as soon as fresh food enters above. But, conversely, irritation of the rectum reacts upon the stomach to empty its contents by relaxing the pylorus, and when this irritation is persistent, as in dysentery, the effects are as just mentioned. Washing out the rectum with quite warm but not too hot water, with a little peppermint, after each movement, and then potassium bromid in a small enema, are each measures which allay this reflex irritation, while the food given should be administered in as small bulk as possible. It is in these cases that scraped raw meat taken in $\frac{1}{2}$ to 1 teaspoonful doses, is so curative, both of the dysentery, by allowing rest to the inflamed bowel, and of the emaciation, by allowing the aliment to stay long enough to be taken up. Milk, while eminently adapted for the treatment of most cases of diarrhea if properly prepared, is, nevertheless, both bulky and slow of digestion, and hence is contra-indicated in the treatment of dysentery, acute or chronic.

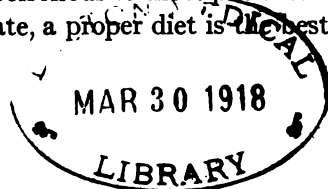
On the other hand, it is surprising how many years chronic diarrhea may continue with some patients without their losing flesh. Whenever, therefore, emaciation does accompany diarrhea we have reason to suspect some constitutional cause, as tuberculosis or Graves' disease.

Many cases of **cirrhosis of the liver** exhibit a wasting of the muscular tissues which cannot be ascribed exclusively to disordered digestion from portal obstruction. The skin also in them shows characteristic changes. It is both rough and dry, and can be lifted in such leathery folds that I have diagnosed hepatic cirrhosis from this symptom when there was no ascites. The face may show emaciation in the sunken eyes and cheeks, and, besides having an opaque and rather sallow tint, there are to be found characteristic areas of dilated venules on the nose and cheeks. These patients often seem to die from pure muscular debility.

In most cases of obstructive jaundice loss of fat occurs early, and this appears to be mainly due to imperfect emulsification of food fats in the intestine from deficiency of bile, as the addition of bile greatly increases the activity of the fat-splitting ferment in the pancreatic juice. If, however, jaundice continues, actual emaciation occurs, the general nutrition apparently suffering from the toxic influence of bile in the tissues.

In **diabetes mellitus** emaciation always occurs, though in the class who from the beginning are very fleshy it may not be so obvious at death, owing to the curious fact that in diabetes other tissues waste faster than the fat does. In the young and in adults who have never been obese the emaciation is often extreme, its progress being progressive from the time that sugar is generated directly out of the protein elements of the body independently of the hydrocarbons of food. I have, therefore, long relied, in the prognosis of diabetes, upon the amount of excess of urea, as well as upon the amount of sugar excreted.

Graves' disease, misnamed "exophthalmic goiter," because many cases occur and progress even to a fatal issue without either exophthalmos or goiter, often causes such extreme emaciation that the patients have all the appearances of advanced phthisis. In some it appears as an early symptom, while in others emaciation does not become pronounced until diarrhea sets in. I regard Graves' disease as due primarily to an auto-infection with a poison generated in the intestine which paralyzes the vasoconstrictors the body over, and which may or may not involve the thyroid gland. (Consult the author's "Graves' Disease, With and Without Exophthalmic Goiter," Wm. Wood & Co., New York, 1904.) This ptomain seems to be generated from nitrogenous elements in the blood, causing butcher meat to be as poisonous to those patients as starch or sugar are to diabetics. At any rate, a proper diet is the best remedy, both for the disease and



for the emaciation consequent upon it. In any patient, therefore, who is plainly emaciated without any cause being discoverable, the diagnosis of Graves' disease becomes quite certain if, with the characteristic persistent tachycardia, the other nervous and secretory derangements of this peculiar complaint are present, though there be no exophthalmos or goiter.

COUGH

Cough is a reflex act whose afferent excitation may come from quite a variety of sources or localities. All coughs, however, may be sharply divided into two classes: first, the expectorant cough; second, the irritant cough.

The expectorant cough is of only one kind, and virtually has but one cause, namely, something to be expectorated. The irritant cough, on the other hand, is not due to anything which may be got rid of by coughing, and hence is always useless, if not harmful. This cough is of many kinds, according to the locality of the irritation. It has no less than twelve varieties, as follows:

1. Direct irritation, usually inflammatory, of the sensory nerves of the mucous membrane of the air-passages from the pharynx and larynx down, without the presence of fluid secretions.
2. Irritation of the pleura.
3. Irritation of the under surface of the diaphragm.
4. Valvular disease of the heart.
5. From the infection of pertussis.
6. Irritation of the external meatus of the ear.
7. Aneurysmal cough.
8. Irritation of the stomach.
9. Irritation of the intestine.
10. Irritation of the cervix uteri.
11. Hysterical cough.
12. Basilar meningitis.

The practical advantage of this classification is that the expectorant cough is the only cough which effects a good purpose, and therefore should be aided and not suppressed. All irritant coughs serve no good purpose, and the aim should be to suppress them. It is of much practical advantage, therefore, to the physician that he should learn how to distinguish the expectorant cough from the irritant cough at once. This can be done by paying attention to the sound of the cough, for the expectorant and the irritant coughs are quite different in their sound. It matters not to which of the many kinds of irritant coughs

he may be listening, the cough itself has one and the same character, while it may likewise be said of the expectorant cough that it does not vary in its distinctive sound either, so that although both may be occurring together, yet the one can always be distinguished by the sound from the other. Thus, the sounds accompanying an expectorant cough are invariably linked together, each cough being joined to the preceding and to the subsequent cough, so that its sound may be likened to that of a chain running over a pulley. This cough, which once begun can be checked only with difficulty, ends with the characteristic sound of expectoration into the pharynx. The sounds of the irritant cough, on the other hand, are always independent of each other, and may be likened to the separate blows of a hammer, and, whether few or numerous, they are not linked together. The term *dry* is applied to this cough to denote the absence of all sounds of fluid connected with it.

For the sake of convenience we will first review the different varieties of the irritant cough:

1. From the experiments of Kohts, irritation of the under surface of the vocal chords in the larynx produces the most violent cough, sufficient, if the irritation is continued, to cause general convulsions. Irritation of the trachea produces much less cough until the mucous membrane at the first division of the bronchi is reached, when the cough is much more violent. The membrane between that place and the next division of the bronchi, though still susceptible, is not as excitable as at the second division, where the irritation then produces severe cough, but not as violent as at the first division. Similarly, the membrane at the third division is more susceptible than the parts between. This susceptibility progressively decreases until it disappears in the smallest bronchi.

2. Kohts found that either mechanical or electric irritation of the pleura will cause an irritant or dry cough. This cough may be very slight when the irritated pleural surface is moderate in extent, but may be violent in proportion to the area of the surface involved. An example of the first kind is the ominous short, hacking cough of incipient phthisis. Owing to the excitability of the cutaneous nerves overlying the affected pleura, this symptom may be of service for diagnosis, for the application of the cold hand there will excite this cough when the same application would not over the apex of the sound lung. The cough at the commencement of acute pleurisy is usually short, owing to its being voluntarily checked by the patient from the pain which it occasions. When fluid accumulates in the pleura the

cough may cease, to return with increased violence upon the absorption of the effusion, when the roughened surfaces of the pleura rub together again. The cause of this severe coughing should be recognized at once by its characteristic sound, and is best relieved, not by anodynes, but by firm strapping of the side. A similar local strapping often mitigates the severe cough accompanying a cavity in a phthisical lung, as the walls of the vomica are always adherent at the wall of the chest, and so produce constant pleuritic irritation.

3. When inflammation of the liver extends to its upper surface, so as to cause perihepatitis, it excites a short, hacking cough due to irritation of the sensory nerves of the under surface of the diaphragm.

4. Cough occurs in valvular disease of the heart most commonly in patients with mitral stenosis. This is due to pulmonary stasis producing congestion of the mucous membrane of the bronchi. In some cases of extreme pericardial effusion cough is produced by pressure on the bronchi or upon the pneumogastric nerves.

5. The cough of pertussis, though at first very similar to an expectorant cough, is due to a specific irritation of the upper air-passages, causing a rapid spasmodic cough ending with the characteristic laryngeal whoop, until it terminates in an expectorant cough.

6. Irritation of the external meatus of the ear may cause violent coughing, and when such coughing occurs without any of the usual antecedents of cough in a child it should lead to an examination of the ear, when it may be found to be caused by a foreign body, such as a bean, put into the ear by the child. Sometimes in adults, examining the external auditory meatus with a speculum may excite cough. According to Dr. Fox, of Philadelphia, the afferent nerve irritated is the auriculotemporal branch of the fifth nerve.

7. The cough produced by a thoracic aneurysm is of laryngeal origin from pressure of the tumor upon the recurrent laryngeal nerves, and occurs mostly when the tumor springs from the transverse arch. The sound of the cough is of a brazen, ringing character. If the tumor, however, presses upon the windpipe or on a main bronchus, the cough is often paroxysmal, and may then be accompanied by expectoration, with stridor on inspiration. It is important to add that a foreign body lodged in a primary bronchus will cause the same sounding cough. A man was admitted in my service at Bellevue Hospital with a diagnosis, made by three physicians, of pneumonia. His temperature stood at 105° F. As soon as I heard him cough I said that this pneumonia must be due to plugging of a primary bronchus by a foreign body. The right bronchus was cut down upon, at my direction,

and a piece of a filbert was extracted, which the man had inhaled from his mouth while in a state of intoxication on a Christmas night revel.

8. The presence of undigested contents in the stomach may undoubtedly cause cough, especially in children during the night. This stomach cough is generally believed in by mothers and nurses, and not without reason, for experimentally it has been shown that irritation of the different branches of the pneumogastric will occasion cough. This cough is dry and paroxysmal, and may be mistaken for whooping-cough. It is claimed by some that it is a frequent accompaniment of malarial infection.

9. It is equally certain that round worms present in the intestine may occasion the same kind of cough; as it so often ceases upon expulsion of the worms such causative connection with the cough is very probable.

10. Some cases of prolonged and severe paroxysmal coughing in women are due to irritation of the cervix uteri. One case of the kind, which had tormented the patient for three years, was found by me to be dependent upon a large polypus protruding from the external os. On the removal of this polypus the cough soon ceased.

11. Many women with hysteria have a loud, barking cough, the genesis of which is obscure. Other signs of hysteria are always more or less present in such patients, and the cough is best treated by remedies directed to the constitutional condition.

12. Kohts found that irritation of the floor of the fourth ventricle, above the center for respiration, excites cough. It is frequently present, therefore, in tubercular meningitis, and is then evidence of the basilar situation of the inflammation.

The expectorant cough has for its purpose to get rid of fluids present in the air-passages. Fluid, as such, is as much a foreign body in the air-tubes as any other substance. All that should be present in these tubes is air, with the mucous membrane of their walls simply moistened by a bland, slightly saline secretion. Now, any foreign body occupying the lumen of a bronchial tube must be quickly removed or the worst results follow in the air vessels beyond the obstruction. This is shown in the special form of pneumonia which occurs in the lung whose main bronchus has been plugged by a solid body accidentally entering through the larynx, as in the case above mentioned. The resulting inflammation is worse than when the air vesicles become filled with the exudate of croupous pneumonia, for this may be absorbed with little damage to the alveolar walls, but in the inflammation excited by bronchiole obstruction the tendency is to a disorganization

involving both the walls of the air-cells and the interstitial tissues between the lobules. Now, plugs of viscid mucus which cannot be dislodged from the bronchioles are just as operative in causing lobular changes as any other kind of obstruction, so that when in a general bronchitis the temperature begins sharply to rise, we have reason to dread the supervention of that mechanically produced bronchopneumonia which makes a bronchitis dangerous. Caseous degeneration of the contents of such lobules prepares the way for tubercular infection, so that patients often correctly ascribe the beginning of their phthisis to a cold which they caught, with its accompanying bronchitis.

The first indication, therefore, in the treatment of expectorant coughs is to make the secretion as fluid as possible. In bronchial hemorrhage, for example, the blood is brought up into the pharynx so readily and with so little cough that the patients think that it comes from the stomach. On the other hand, when the secretion is very viscid, the cough on that account may be violent and distressing, because there is no stopping it until it ends in expectoration. The tough pellets of mucus then, like other foreign bodies in the air-tubes, set up reflex spasms of the bronchi, causing wheezing râles, as well as spasmodic laryngeal stenosis, which imparts a husky or squeaking sound to the cough, which, on that account, is often called "tight." A number of serious results follow, not primarily from bronchitis, but from viscid, adherent mucus. Many cases of chronic bronchitic asthma with resulting pulmonary emphysema are thus set up purely by the character of the bronchial secretion, which, if dealt with in time, might have been wholly prevented by remedies calculated to make bronchial secretion simply fluid, as will be mentioned in the chapter on Bronchitis.

An inflammatory condition of the air-passages, however, constantly excites cough of the irritant kind, independent of secretion to be expectorated. This is particularly the case in laryngitis, when the sound of the cough is quite characteristic, being of a brassy or ringing character from spasm of the vocal chords, when it is also accompanied with stridor on inspiration. But the same inflammatory irritation, wherever situated in the air-passages, will excite cough, so that in most patients with bronchitis we have much useless coughing, which aggravates the existing inflammation. By noting the accompanying sounds the physician can infer how much of the cough is due to mucus to be expelled, and how much is only irritant and occurring between the intervals of the expectorating cough. If the secretion becomes more

liquid, the irritant cough becomes less, but if it unduly continues, the indication is then to suppress it by the addition of anodynes to the expectorant agents. On the same principle, the injurious cough of laryngitis is soothed by the steam of boiling water and syrup led from a croup kettle under a tent in which the child lies.

A different condition from the preceding is when there is too abundant watery secretion. This occurs especially in the chronic coughs of old people with weakened and dilated right ventricle of the heart. This fluid bronchial secretion is prone to collect at the bases of both lungs, and its expectoration causes much trouble to these debilitated patients, especially in the night. The indication here is to strengthen the heart walls by appropriate remedies, and check the secretion by mineral acid astringents, especially nitric acid, and small doses of iodids.

SIGNIFICANCE OF DYSPNEA

Dyspnea, or difficult breathing, may be of threefold origin, pulmonary, cardiac, and hemic, or that caused by conditions of the blood itself.

In the first, or pulmonary, the dyspnea may arise from disorder in the lung, or in its appendages, the bronchi or the pleura.

The lung may be affected by inflammatory exudation into its air-vesicles, as in croupous pneumonia. Usually, however, this exudation fills up but a portion of one lung, when the patient may have but moderate dyspnea and lie on the affected side. If in this condition he shows signs of dyspnea, with dusky countenance and rapid breathing, these symptoms are those of toxic origin. The respiratory region of the face, or the nostrils and upper lips, will then give their signs, namely, dilatation of the nostril corresponding to the affected side, with the mouth slightly opened. When both lungs are affected the signs of dyspnea are usually more pronounced, but are still not so evident as in other cases of difficult breathing.

Urgent dyspnea may also supervene when air suddenly accumulates in one pleural cavity. I was once called in consultation by two physicians to see a case of pneumonia. I found no pneumonia, but instead a total absence of respiratory sounds with general resonance on percussion over the whole of the left lung. The explanation was that the patient had a small area of tuberculous infiltration at the apex, which had softened, but, instead of the pleura adhering as usual at that spot to the rib, it left a small hole which allowed the inspired air to pass into the pleural cavity until the lung itself collapsed from pneumothorax, while the suddenness of the accident caused the great dyspnea.

The opposite conditions of the air-vesicles, when instead of being filled with exudation they are overdistended with air, causes very pronounced dyspnea. This, however, is an emphysematous condition, as it is consecutive to chronic bronchitis or asthma. The respiratory movements of the chest walls are then much restricted and may be simply up and down. Both nostrils are also distended.

Affections of the bronchi are frequent causes of dyspnea. This may be of purely nervous origin, as in asthma. Being bilateral in character, the patient cannot lie down. Auscultation quickly reveals why the breathing is difficult, for the air cannot come out freely from the lung, but is delayed in expiration by bronchial spasm, which causes whistling or wheezing sounds over both lungs.

Urgent dyspnea may be caused by inflammation with spasms and exudation in the larynx, as in membranous croup. In bad cases the lower ribs, instead of expanding with inspiration, fall in.

Narrowing the chink of the glottis may also cause dyspnea from spasm of the vocal chords by the presence of an aneurysm pressing upon the recurrent laryngeal nerve. In all these cases of laryngeal obstruction the accompanying cough is brassy in character, as it is also when a main bronchus is plugged by a foreign body.

Bronchitis does not cause dyspnea so long as the main bronchi only are involved, but when the inflammation extends below the third division of the air-tubes the breathing becomes labored. Orthopnea, or being obliged to sit up for breathing, then sets in.

Fluid effusions into the pleura on one side, if gradual in their production, may cause no dyspnea. The patient may then go about for days without knowing that he had serious trouble, except that he finds he is short of breath. The nostril on the affected side, however, will be widely dilated. When pleural effusion occurs rapidly on both sides the dyspnea is extreme.

Cardiac dyspnea may be due to conditions in the heart itself, or in its appendages, the blood-vessels and the pericardium.

Pericarditis with effusion may cause great difficulty in breathing when the effusion is so great as to embarrass the heart in its movements. The most frightful dyspnea, however, occurs as a result of peripericarditis, when the inflammation of the pericardium extends outside that structure and attaches it to the sternum and to the adjacent ribs. These external adhesions prevent the heart itself from contracting, so that it becomes much dilated and not capable of completely emptying its cavities. Nothing but tightly strapping the lower left ribs gives any relief, and that, at best, is but temporary.

Owing to the importance of early recognition of the condition, we would allude first to difficult breathing due to the state of the arteries. Many persons after middle life begin to notice that they cannot walk as fast as before, or that they soon get out of breath going upstairs or in walking against the wind. Otherwise they feel quite well. But this incipient dyspnea is the first sign of beginning arteriosclerosis with its long train of evils, whose nature and prophylaxis we shall discuss at length hereafter.

Degeneration of the myocardium of the heart wall itself so that it is not equal to carry on the circulation may cause intense dyspnea, though there may be no valvular obstruction. The signs, then, are absence of palpable beat of the heart externally, along with a very intermittent pulse, often accompanied by dropsical swelling of the legs. The patient cannot lie down and has to sleep sitting up in a chair. This dyspnea rapidly subsides with free dosing of digitalis, squills, and permanently by iron and open-air breathing, the best sign of improvement being that the pulse no longer intermits.

Conditions of the blood itself rarely cause dyspnea. Great impoverishment of the red corpuscles, as in pernicious anemia, will frequently cause rapid breathing, but no real difficulty in breathing. There is one form, however, fortunately quite uncommon, in which fatal dyspnea of the most aggravated character occurs from the formation in the blood of a multitude of small emboli of fat which plug up the pulmonary capillaries. This occurs in that mysterious disease diabetes mellitus, but why, is as unknown as many other problems in that disease.

Dyspnea caused by valvular disease of the heart occurs most commonly in cases of mitral stenosis when the lungs become engorged through inability to drive the blood through the narrowed mitral valve. Mitral regurgitation, on the other hand, may persist for years without causing dyspnea, until its terminal effects are seen in widespread venous engorgements with dropsical effusion which bring on difficult breathing. Orthopnea, or having to sit up to breathe, should always attract attention, for it means that both lungs are involved in the difficulty of breathing, and, of course, this occurs oftener in cardiac than in any other disorders.

SIGNIFICANCE OF EDEMA

While the presence of edema is one of the most easily recognizable of morbid conditions, pathologists find its mechanism quite difficult to explain. Thus, many suppose that whatever arrests the return

current through the veins and lymphatics will cause a watery leakage from these vessels into the tissues of the part. The dropsy from heart disease, and abdominal dropsy or ascites from venous obstructions in the liver are regarded as sufficient illustrations of this principle. But there is no dropsy more general or complete than in some forms of kidney disease. But where is venous or lymphatic obstruction in them? Again, if it be disorganization of the kidney structures which causes universal dropsy, why do so many cases of wasted and chronically ruined kidneys in chronic interstitial nephritis never show a sign of dropsy anywhere? Again, what is the relation of edema in general to inflammatory effusions? Is the great accumulation of fluid in the pleura or pericardium in inflammation of those serous sacs wholly different in its etiology from dropsy in the peritoneal sac accompanying cirrhosis of the liver? Or, again, how does edema of the lungs with no edema elsewhere sometimes occur so suddenly in Bright's disease?

These questions, suggested by bedside experience, show that the subject of edema is, to say the least, extremely complex, and ere long its study will be found to involve the question of the mechanism of absorption as well. Now, it happens that the physiology of absorption is equally a subject of very diverse interpretation among investigators, according to their physical, clinical, dynamic, or vital cellular explanations. Against the mere mechanical theory of dropsy, that it comes from overdilatation of obstructed blood-vessels, are such facts that ligation of the femoral vein in a healthy man may have no effect whatever on his leg, and in the experimental laboratory it is found that even ligation of the lower end of the inferior vena cava in dogs produces no edema of the legs.

Also, if we produce an artificial plethora and overfill the blood-vessels by injecting large quantities of normal saline solution into the circulation, we still fail to produce any dropsy.

As an illustration of the wholly unsettled state of opinion on the main principles underlying this subject, we would briefly advert to two of the most recent observations regarding it. Professor E. B. Starling, of Guy's Hospital, says that everything seems explicable on the purely physical principle of diffusion, filtration and osmosis; but Professor E. Weymouth Reid, in Schäfer's "Text-Book of Physiology," says that when we come to the living body it is rare to find in it the conditions present for a free diffusion between the constituents of two solutions. If a pig's bladder separates methyl alcohol and ether, the methyl alcohol diffuses into the ether, but if a caoutchouc mem-

brane separates the two solutions, the ether diffuses into the alcohol. He goes on to say, "It must be admitted that in spite of the great labor that has been expended on the determination of endosmotic equivalents on different substances with different membranes, the results obtained are of no value to the practical physiologist. In the living body the conditions for the interchange of water and the constituents of solutions through membranes are evidently exceedingly complex, for in spite of the magnificent labors of Dudrodet, Graham, Pfeffer, Vant Hoff, and others, the enigma of the physical chemistry of protoplasm still puts a limit to the physiologist's conception of the modes of motion of fluids through the membranes of the body."

But when Professor Starling comes to Bright's disease dropsy he quits the field precipitately, thus, "One of the most important forms of dropsy, namely, that which accompanies renal disease, was placed by Cohnheim in the category of inflammatory dropsy, and that seems a necessary conclusion, in view of the fact that we are unable to trace any adequate mechanical cause, such as raised mechanical pressure, to the increased transudation. We know very little more about this form of dropsy than was known in Cohnheim's time." We would simply add, that however little we know about the matter now, we do know that typical renal dropsy has not a single inflammatory element in it.

Much the most decisive experiment in illustrating this subject is, in our opinion, that of Leathes and Starling, who first induced pleurisy on one side by the injection of extract of jequirity into the sac, having previously ascertained by autopsy how long it took an animal to recover from this pleurisy so that the membrane was restored to a wholly healthy state. They then induced artificial plethora by injecting large quantities of normal saline into the blood of a dog, which had had time quite to recover from its artificially induced pleurisy. But the dog speedily perished by asphyxia from an enormous effusion into the pleura of the side which had been experimented on, while there was no effusion whatever on the other side. Now, certainly, that recent inflammation should change this serous membrane into a tissue no better than a piece of muslin to hold increased blood tension, is a fact of great significance. It shows that weakened nutrition of the walls of the blood-vessels is probably the leading factor in all dropsies, and this devitalization may be produced in various ways, either by impoverishment of the blood, by inflammation, or by blood-poisoning, as in renal dropsy.

SIGNIFICANCE OF VOMITING

The vomiting center in the medulla is the most susceptible of nervous centers, and hence the exciting causes of this symptom outnumber those of all other single morbid signs which we have mentioned, yet scarcely once in ten cases of vomiting will the stomach be found to be itself at fault. Its significance, therefore, is very variable, meaning little in one case, and enough in another to make it a most important danger-signal. Amid such a diversity of causes, ranging from a brain tumor to a renal calculus, or from the onset of pneumonia to seasickness, it is best to begin with those signs which show that the stomach is vomiting on its own account and is to be dealt with accordingly.

Any inflammatory process in this viscus will excite vomiting, but this, then, will be associated with other symptoms which are valuable for definitely indicating that such a condition of the stomach is the cause of the disturbance and not something else. Those signs which are never absent are tumefaction of the epigastrium, with muscular rigidity and more or less tenderness on palpation. In severe acute gastritis, pain is also pronounced and is referred to the stomach itself, while there is more or less fever with persistent nausea. The vomitus shows first the stomach contents, then mucus, bile, and, after severe retching, streaks of blood. Owing to the dry state of the mucosa, which becomes coated with viscid mucus, there is much thirst. Liquids may then be freely allowed, which by dissolving the mucus diminish the retching enough to make the vomiting easier. In some cases the stomach is so irritable that a teaspoonful of water is at once rejected. A couple of leeches applied to the epigastrium may then prove serviceable to lessen both the pain and the vomiting.

In chronic gastritis vomiting is very frequent, but more intermittent. Such is the morning vomiting of old alcoholics, when their thirst leads them also to drink quantities of water. If questioned, they ascribe their nausea to catarrh of the head dropping down the throat, an impression strengthened by the amount of mucus which they bring up. Here, again, tumefaction of the epigastrium with rigidity and tenderness to palpation are diagnostic.

In ulcer of the stomach vomiting occurs, as a rule, soon after taking food if the ulcer be near the cardia, but more delayed if near the pylorus, and here pain and local rigidity with throbbing often occur. If the vomiting does not come on until more than an hour after taking food, the pain meantime increasing, there is reason to apprehend the complication of spasm of the pylorus. The vomitus should be care-

fully inspected for signs of blood, which may be detected in about one-third the cases of gastric ulcer, though not in amount to be termed hematemesis.

Vomiting may be of particular significance in diagnosis of gastric cancer. If a patient after middle life, who has not had stomach troubles before and has been temperate in eating and drinking, begins to suffer from dyspepsia with a sense of a load in his stomach, then persistent nausea, and finally vomiting, malignant disease is to be apprehended, though no other local signs are yet appreciable. Cancer of the fundus may develop into a large tumor without vomiting, but if the location be either at the cardia or pylorus, nausea and vomiting are rarely absent. It may recur repeatedly during the day, but if stricture of the pylorus develops, causing gastric dilatation, the vomiting may be deferred for several days, and then be great in amount, with much decomposition of the contents. This happens also in dilatation of the stomach from other causes. In the early stages of cancer the ejecta may not differ from those of chronic gastritis, but the vomiting of blood becomes almost pathognomonic of cancer when it has the appearance of coffee-grounds or dark chocolate, and is kept up for days together.

The most serious significance attached to vomiting is when it accompanies some accidents to an abdominal viscus. Many lives have been sacrificed from failure to recognize in time the import of the association of the symptoms with abdominal pain. An appendicitis begins to be a serious matter when repeated vomiting comes on, likewise an intestinal obstruction of any kind or a hernia, or volvulus, or an intussusception. If the precise lesion be concealed, or not easily located, nevertheless abdominal pain with vomiting means a danger. It will be a relief to find by their proper signs that a hepatic or a renal calculus is the cause of both these symptoms, for then morphin may be injected, but not so if no such explanation is forthcoming. The supervention of peritonitis upon an abdominal derangement may be apprehended if vomiting sets in, because peritonitis, if at all extensive, always causes vomiting, the ejecta then being usually of a grass-green color.

Sir Wm. H. Bennett in his lectures ("British Med. Jour.," March 24, 1900; "Lancet," July 8, 1905) makes some valuable recommendations about the treatment of vomiting when the ejecta are putrid or sterco-raceous. Such vomiting may be met with in any form of intestinal obstruction, or in peritonitis alone, or after certain abdominal operations or injuries. His recommendation is to treat such vomiting with continuous drafts of lukewarm water, for though they are immediately

vomited again, yet in time the stomach becomes quite cleansed of its injurious contents, and this of itself is a great recommendation.

Vomiting is of serious import when it occurs in tubercular meningitis of the base of the brain. Its characters then are that it is ejectile, but the abdomen, instead of being distended, may actually be retracted, with none of the rigidity characteristic of gastritis. Vomiting is also significant when it comes on in acute fevers, notably at the onset of pneumonia and of scarlet fever.

Of the remaining infections, such as measles and typhoid, vomiting is not an initial symptom.

CHAPTER III

REMEDIES

NON-MEDICINAL

IN a work on clinical medicine some allusions should be made to the action of remedies, for it is not too much to say that a practitioner will succeed or fail according to his use of remedies. They may be divided into non-medicinal and medicinal. Of the first class we would mention electricity, cold, heat, and change.

Electricity.—Of the non-medicinal remedies some of the recent applications of electricity may be mentioned, or the high-frequency currents according to the d'Arsonval method. The application of such a remedy, however, necessitates the use of an electric mechanism which produces a high-frequency current, either from a static machine or from an induction coil. Its most marked effect is to reduce a pulse of high tension, the existence of which should have been proved by a sphygmomanometer. The register for health of blood-pressure varies with age—for a young person it may not be above 140 to 160 mm., the latter figure being normal for a person forty-five years of age. After that it rises with each year, reaching 200 in many cases at seventy years, but the condition is often morbid, and caused by arteriosclerosis and by chronic kidney disease, when it rises to 200 to 220 or even 250 mm. Anyone with such a blood-pressure as this is in danger of the formation of aneurysms or of apoplexy. The d'Arsonval current, however, is a very efficacious means for reducing the blood-pressure even below what would be the normal for the patient's age. It does so for a few hours only, but if the applications be kept up twice a day or every day it often causes a more or less permanent reduction in arterial tension. One other property of electricity may be here mentioned, which is the local dilatation of any superficial arteries by a battery of the ordinary interrupted faradic current. By this means a local increase in the rapidity of the arterial blood may be caused between the poles of the battery, however near they may be to each other. This enables us to restore the muscular contractility when it is lost in very small muscles, such as the interossei of the fingers. Equally a rapid arterial current causes absorption of

the exudation, and hence I have used this for removal of opacities of the cornea caused by antecedent inflammation. What, however, is useful for small areas, can be equally beneficial in all inflammatory effusions, so that, with one pole of the battery applied at the nape of the neck and the other passed over the surface of the corresponding side of the chest, quite an extensive effusion into the pleura and other inflammatory exudates may be absorbed, on the same principle that a blister causes disappearance of an effusion by increasing the flow of the arterial current underneath. On the same principle, joints that have been fettered by chronic rheumatic inflammation may be set free by the frequent repetition, two or three times a day, of the faradic current, the poles being laid at opposite points on the joint.

The Action of Cold.—This class of remedies owe their properties to actions upon the vasomotor nerves, of which cold is a good illustration. Cold, as an irritant is *per se* depressing, but it has the characteristic effect of producing a reaction when its impression ceases. So long as the impression of cold is felt, it produces arterial contraction and anemia of the part. This property may be of use in localized inflammations, as in joints, by the application of ice-bags to them. Care should be taken, however, not to continue the application too long. Ice-bags should never be applied directly to the skin without the interposition of a cloth of some kind, for the anemia induced may cause gangrene. It is a safe rule to be guided by the sensation of the patient. So long as the application of cold relieves pain and reduces swelling it may be continued until the application becomes disagreeable, whereupon it should be discontinued at once. Thus, after a fracture or other cause of local inflammation, the application of ice-bags may be kept up beneficially for three weeks, but the very next day, if the cold is no longer agreeable to the patient, it should be discontinued. In cases of uncertainty the ice-bags should be removed to test whether the pain of the inflammation returns or not. If the patient feels better without the ice-bag than with it, cold is no longer applicable.

On account of the constriction in the arteries cold can be used as a hemostatic. So soon as the direct impression of cold ceases, it is followed by a reaction which constitutes one of the chief remedial uses of cold. This reaction produces the so-called tonic effect of cold baths and of locally cold douches. The word "tonic," however, is a loose and vague term derived from music, and suggests a comparison with the strings of a violin being tightened up, but under this term such entirely different agents as iron, cod-liver oil, arsenic, quinin, a cold bath,

and a sea voyage are often included. Cold as a tonic acts solely by the reaction from it. If the primary depression of cold is too great for adequate reaction, cold is the very opposite of a tonic. The degree of its primary irritation, therefore, must always be carefully adjusted to the patient's powers of reaction. The cold which would invigorate a strong man by a shower-bath, would wholly depress a convalescent from a fever; who, on the other hand, might be benefited by a shorter and milder application of this agent, such as by cold sponging.

Heat.—The application of heat to a part differs, whether it be dry heat or moist heat. Dry heat is a pure stimulant and moist heat is a pure sedative. Dry heat, therefore, may be applied for the purpose of restoring a patient from heart failure or syncope by the use of bottles of hot water or similar measures. Care, however, should be taken in cases of insensibility not to blister the parts, which may occur when the patient has recovered. I once had serious trouble with the blistering of the feet from hot applications while the patient was insensible.

Dry heat applied to the feet is our most efficient emmenagogue through the vasomotor associations between the feet and the circulation of the pelvic viscera. Cases of amenorrhea are usually characterized by prolonged coldness of the feet, especially on retiring to bed, but by persistent heating of the feet by various means, such as warm soap-stones or other foot warmers, I have succeeded eventually in restoring the menstrual functions which had been suppressed for several years. Moist heat, on the other hand, is always sedative, as is illustrated by the applications of poultices to relieve pain. It produces relaxation of muscular spasm, whether it be spasm of the arteries or of the systemic muscles. In the days preceding the knowledge of anesthetics, patients with dislocation of the hip-joint were immersed in sitz-baths of hot water until they felt faint, whereupon the relaxed muscles allowed of the restoration of the dislocation. There is no agent equal to moist heat for counteracting muscular spasm. On one occasion I found a man at the Roosevelt Hospital who, as a sequel to spinal meningitis, had every muscle of his arms and legs thrown into rigid contraction. His heels were buried in his buttocks, and the knees forced together until ulcers formed on the internal condyles. The nails also had grown into the palms of his hands from inability to overcome the contraction of the flexors. He begged not to be touched because of the agonizing pain produced by any attempt at stretching the contracted muscles. I told my house staff that we would enable him to walk out of the

hospital without giving him any medicine; and so it proved, for by douches of warm water continued a half-hour at a time, three times a day, his contractions were relieved, and two months afterward, when I met him, he told me that he fell overboard from a boat and had to swim for his life. Similar success may be expected in any case of joints crippled by rheumatism, however prolonged the disability has been, by the use of douches of hot water. Unfortunately, this is the case only with rheumatic stiffening, for if caused by gout, it is not nearly so successful.

Change.—This is not the place to speak of the great part which is played in life by habit. Habit, indeed, is the main organizer of the whole nervous system, but, apart from this, every practising physician has had occasion to note the beneficial effects of breaking up morbid habits by simple change. This is sometimes wrongly ascribed to change of air. But as many a resident in the city is benefited by going to the country, the immediate effect of which is to improve sleep and appetite, we often hear the change ascribed entirely to the country air; but, on the other hand, the farmer's wife is as much benefited by the change in her monotonous life in the country air by a visit to her cousin in the city. The real cause of the amelioration lies in the breaking up of recurrent, morbid habits by alteration of surroundings; in other words, by simple change. A prolonged continuance of the same impressions without change is always injurious, particularly in the case of nervous diseases. I once had this strikingly illustrated in the instance of a gentleman who suffered from the grave malady paralysis agitans, which progressed in his unvarying life for several years at his country place until he could no longer walk across the room or feed himself, and finally became affected in his speech. I recommended that he should be removed to his city residence; and this man, after taking a ride of some twenty miles in his carriage, got out unaided, walked up the steps of the house, and rang the door bell. Two days afterward he walked a mile to my office in the city, and ever after, taking the hint from this experience, he kept up changing his surroundings, staying at different places for not more than two weeks at a time. We may say here that the benefit of this remedy, change, is usually limited to two weeks. This remedy is also of the greatest use by altering chronic morbid tendencies which so often culminate in insanity. Much the greater number of cases of insanity, if investigated, will prove to have been preceded by injurious mental habits of long duration, and nothing so commonly arrests this dreadful malady at its beginning as removing the patient to new surroundings, where not only

new sights but new faces involuntarily attract his attention, and thus displace the recurring unhealthy mental habits.

But it is not only in nervous diseases that change of surroundings is beneficial. Serious chronic constitutional disorders, such as tuberculosis and Bright's disease, may be temporarily and yet markedly benefited by change of scene and surroundings, so that we must admit that injurious habits of nutrition not infrequently complicate constitutional disorders, which may be quite advantageous to break up by mere change.

MEDICINAL

A medicine is a remedy which acts by entering the circulation in a state of solution. By the circulation we do not mean only the bloodstream, for the interstitial fluids outside of the blood-vessels are also in constant and rapid movement, as is shown by the prompt action of soluble medicines given hypodermically. My own classification of medicines is into the functional and constitutional remedies. The difference between function and structure may be illustrated by an oil-lamp, whose function is to give light. Now, function is always deranged by derangement of structure, but the reverse is not true; complete derangement of function may occur without any derangement of structure. The light-giving function of a lamp may be destroyed by injuring the lamp's structure; but it may not at all give light, while its structure is perfectly intact, if its wick is immersed in water instead of in oil.

The *functional medicines* have no effect upon the constitution, but only act upon its functions or modes of working. Their great characteristic is that their whole action is secured by one dose.

However often that dose be repeated, the last dose does not produce any other effects than the first dose. This is illustrated by the inhalation of the smoke of stramonium leaves for the relief of an asthmatic paroxysm. Though this inhalation may be practised for years, the only effect which it produces is to relieve, each time, the symptom spasm of the bronchial muscles, while the disease asthma continues as before. A functional remedy does not produce any constitutional effects, however large or dangerous its dose. A man may come very near death from an overdose of opium, but if he recovers, in twenty-four hours he shows no more effects from this poison.

A *constitutional medicine*, on the other hand, does not produce any apparent effects by one dose, but only after the prolonged and systematic administration of many doses, such as in the treatment of anemia by iron, or of syphilis by mercury. Constitutional medicines,

therefore, do not relieve symptoms, for the symptoms only disappear with the cure of the disease. In other words, functional medicines relieve symptoms only, while constitutional medicines relieve not only symptoms, but also the diseases themselves.

Functional medicines are divisible into three classes: first, the *nervines*, or those which act upon some nervous function; second, the *eliminatives*, or those which increase gland secretion—these are divisible into emetics, cathartics, diaphoretics, and diuretics; and the third class are the *astringents*, which cause muscular and fibrous tissues to contract. Now, as to *nervines*, there is no general nervous anything; there is no general nervous stimulant or general nervous sedative, except death. The most important members of this class are those which are both stimulants and sedatives at the same time, but they are so because, being always partial in their effects, they may stimulate certain nervous functions, while they depress others. Thus, opium is a powerful stimulant to the brain or to mental functions, and is taken for that purpose by opium habitués. It is also a stimulant to the heart, causing it to beat very regularly and the arteries to dilate, so as to give a full pulse. While it is thus acting, it simultaneously depresses or checks the secretions and the movements of the gastro-intestinal tract, and relieves pain in inflammations.

Other divisions of the *nervines* are those which are pure stimulants, of which ammonia is an example, and those which are pure sedatives, such as hydrocyanic acid. The eliminants or stimulants of gland secretions are fully described by their names. They also act only in one dose, for if one takes a cathartic he does not expect to wait until the following week before it operates; so the astringents are sufficiently explained by their names.

Certain facts about the functional medicines should be noted, namely, that their actions are always physiologic, and show the same effects in health as in disease. Opium or strychnin would have the same characteristic effect upon the healthy as upon the sick. It follows, therefore, that we do not get the effects of any functional medicine as a remedy until it produces its physiologic symptoms. Thus, in gangrene, in which opium is of great service as a stimulant, it may have to be given in doses ten times as large as usual before the characteristic, physiologic symptoms of opium, such as contracted pupils and slowing of the breathing, develop.

The same may be said of *veratrum viride* when given to reduce the tension of the pulse in puerperal convulsions. Here, instead of 5 drops, 120 drops may be necessary to show any effects upon the pulse.

The constitutional or disease medicines may be divided into two classes: those which are natural to the system and presumably act by making up some deficiency, such as iron in non-febrile anemia, and hence may properly be termed restoratives; or those which are unnatural to the system, such as mercury, iodine, bromine, or arsenic, which class is usually termed alteratives. Being unnatural to the system, these agents are poisonous, but it must always be borne in mind that their poisonous action is not the same as their remedial action. Whenever, therefore, they show symptoms of their poisonous actions they cease to be remedies, and their dose should be lessened or abandoned. Thus, when mercury produces salivation, or iodine produces the symptoms of iodism, or the bromids produce symptoms of bromism, they are no longer acting as remedies. In their administration, therefore, care should be taken to avoid all symptoms of poisoning by them. The validity of this principle is shown by the fact that mercury can act as a cathartic or functional eliminative medicine, and is often given for that purpose, but if so, it ceases to act for the time as a constitutional medicine.

In some cases, however, the action of constitutional medicines is promoted by combining with them some of the functional medicines which relieve the symptoms of the disease. Thus, arsenic and potassium iodide belong to the constitutional medicines, but in the treatment of asthma, as an example, it is well to combine with both these medicines such functional medicines as belladonna and the compound spirits of sulphuric ether in the same prescription with the arsenic and the iodide.

It is a good rule to postpone as long as possible the poisonous effects of alteratives by simultaneously administering restoratives for that purpose.

VACCINES

BY JOHN EDGAR WELCH, M. D., NEW YORK CITY

The science of bacteriology, by establishing the etiologic relation of bacteria to pathologic processes, both of a local and general character, opened a new field for observation and study.

It was soon observed that organisms act in two ways in producing the clinical reactions we know as disease. In one instance, best illustrated by the diphtheria bacillus, the organism lodges on a mucous membrane surface, usually over the tonsil and adjacent parts, where it multiplies without entering into the tissues or circulation. During its development, however, it liberates a toxin, which is to be consid-

ered as a metabolic product of its growth. This toxin is absorbed by the tissues and circulates in the blood, producing the symptoms of diphtheria.

Typhoid fever represents a clinical reaction which is produced in another manner. In this disease the *Bacillus typhosus* gains entrance to the circulating blood and organs of the body, especially the spleen. Numerous bacilli are constantly being killed and disintegrated by the defensive agents of the body. In the process of disintegration a toxin is discharged into the body fluids which gives the disease-picture we call typhoid fever. The poison of the typhoid bacillus does not escape from the live, intact micro-organism in which it is firmly held, but can be liberated only upon the death and disintegration of the micro-organism.

The toxin of the diseases illustrated by diphtheria is called exotoxin, and is liberated freely by the living micro-organism. The toxin of the diseases illustrated by typhoid is called endotoxin, and is liberated only upon the disintegration of the micro-organism.

It is against the class of micro-organisms furnishing endotoxins that vaccine is employed as a therapeutic and prophylactic measure.

Immunity, whether active or passive, is a state which is imperfectly understood. However, the serum of those enjoying this condition shows, usually, three substances which are known to take active part in combating bacteria. These are: opsonins, amboceptor (antibody), and agglutinins, all of which can be produced in the serum of non-immune animals by the intraperitoneal injection of bacteria.

The opsonin is a substance which sensitizes the bacterium in such a way that it is prepared for ingestion by the polymorphonuclear leukocytes. But for this opsonic action the leukocytes would be incapable of acting as phagocytes.

The amboceptor is a reaction body which sensitizes the bacterium and prepares it for digestion by the ferment called "complement," which is a constituent of all normal sera.

Agglutinin is a substance appearing in the serum of an animal after inoculation with bacteria which causes the bodies of the bacteria to adhere to each other. The exact interpretation of this phenomenon is impossible. It is observed frequently to precede disintegration of bacilli and is supposed to have some intimate relation to that process. Just how active agglutinin is in contributing to immunity is not certain, but it is definitely known that the opsonin and amboceptor are very important factors, especially the opsonin. It is this body that is produced in abundance after the injection of vaccine.

The term "vaccine" is applied to a suspension of killed bacteria in normal salt solution, and is not to be confounded with serum. Vaccines are administered by means of a needle and should be injected intramuscularly. They should be made from the same variety of organism which is infecting the patient, and, if possible, made from cultures taken directly from the patient, in which case the vaccine would be designated "autogenous" to distinguish it from "stock vaccine," which is made from the same organism, but another strain, *i. e.*, from some other source than the infected individual, and kept in stock.

Vaccines are used both as a prophylactic and therapeutic measure, but in the field of prevention seem to have proved of most value. The United States Army, by means of prophylactic vaccination of troops against typhoid fever, has practically eliminated this disease from among the enlisted men.

As a therapeutic measure vaccines are used both in local infections and in bacteremia. In the latter condition great care and judgment should be exercised in their employment. Those cases of bacteremia which have high temperature, rapid pulse, and otherwise show signs of a severe infection, are probably reacting to their bacterial infection to the full extent of their ability. An injection of vaccine under these conditions probably adds fuel to the fire, and the fresh acquisition of poison by the system is liable to be detrimental rather than beneficial. On the other hand, those cases of bacteremia which tend to run a more protracted course, with little fever, are apt to improve by the vaccine treatment through the fact that their immunity apparatus is stimulated to greater activity.

The local superficial infections, such as furuncles, abscesses, etc., furnish more favorable conditions for vaccine treatment. The inflammatory process surrounding any localized infection prevents a free passing of the toxins into the general circulation. In consequence, the organs contributing to immunity lack sufficient stimulus for the formation of opsonin and amboceptor in sufficient quantity to properly overcome the local focus of organisms. By the injection of vaccine the production of immunity bodies is stimulated in sufficient quantity to overcome the local focus of bacteria.

In addition to its good results, as above mentioned, vaccine has proved of considerable value when used against infections of mucous membrane surfaces, such as colon bacillus, pyelitis, and cystitis.

PART II

THE INFECTIONS

CHAPTER I

GENERAL INTRODUCTION AND CLASSIFICATION

THE subject of the infections leads into the widest fields of medical science. But those fields all lie within 10 inches from the naked eye, and therefore could have been explored only by the invention of the modern microscope. In that field a vast kingdom of life has been thus discovered to whose forms the term "micro-organism" has been given. Among such micro-organisms are those infectious agents whose entrance into our bodies and multiplication there occasion their corresponding diseases.

That these infectious agents are true growths is proved by their reproduction being specific. They always breed true. Measles cannot cause anything but measles, and not scarlatina, with which it was at first confounded, any more than the seed of a turnip can produce a carrot. It is now universally admitted that each infectious disease is caused by its own specific germ and by no other.

We now know, however, that micro-organisms constitute the largest as well as the most ancient division of the kingdom of life, for whereas all visible forms, whether of plant or animal, are necessarily local, the micro-organisms are everywhere where life is possible.

To their living activities are due the vast majority of deaths, because only an insignificant fraction die by storm, flood, earthquake, or similar physical accidents. Deaths by micro-organisms are not accidental, but natural, for even derangements of vital organs, like those of the heart and kidneys, simply prepare the way for those so-called terminal infections by vast numbers of micro-organisms, which are the immediate cause of dissolution.

As all forms of life come from previous forms of life, so is death a characteristic of life only. A stone never dies; nothing dies unless it has first lived. Hence death is a necessary factor in life, and there can

be no life without the way be prepared for it by death. Thus no tree which falls in the forest, nor the body of a beast dying in the field would decompose spontaneously any more than would stones. But so soon as plant or animal dies, their remains are at once attacked by microbes to resolve them back to dust. Therefore, but for micro-organisms the earth would soon be choked with its own dead.

It is natural that micro-organisms should be regarded with dread as causes only of disease and death. But this is far from the whole truth. The great majority of these infinitely numerous living things are harmless to us, and many of them actually beneficial. It is only certain of them which cause disease by multiplying in our bodies.

These latter are divisible into two classes: first, the facultative parasites, which may live outside the body, but become causes of disease when they gain entrance into it. Thus the tetanus bacillus is one of these, as its natural habitat is in the soil, and can become fatal only by gaining entrance through some wound or similar lesion. These micro-organisms are also called saprophytes.

Obligate parasites are those which can live and multiply only in the living bodies which they invade, such as the agents of small-pox and typhoid fever.

It should be here noted that it is by no means enough for pathogenic micro-organisms to gain entrance into the animal body. If that were all, the human race would long ago have become extinct. After they gain entrance they must find the soil suitable for them to grow and to multiply. Their mere entrance into the body may cause no trouble. Thus, in every epidemic of diphtheria its specific bacillus abounds in the throats of attendants on the sick without occasioning any disease, and so for a multitude of other infective agents, such as those of Asiatic cholera, cerebrospinal meningitis, pneumonia, and, above all, tuberculosis.

Micro-organisms are further divisible into the bacteria which have vegetable affinities and the protozoa which are of animal nature. The term "bacterium," however, is a misnomer, derived from a Greek word meaning a rod, but the most formidable members of this class are round and are called "cocci." When these occur in pairs they are called "diplococci," but when they occur adhering together in chains they are termed "streptococci," and if they adhere in bunches they are named "staphylococci." The bacilli occur in the form of rods of varying length. Many bacteria, whether they be cocci or bacilli, are contained within a capsule; they are all unicellular and multiply by simple division.

The protozoa are of comparatively recent discovery, but they are constantly gaining in number and importance. Bacteria, owing to their vegetable nature, can be cultivated, and hence are more readily identified, while the protozoa, not being often capable of cultivation, are not so easily identified. Micro-organisms are of many different sizes, some of them, indeed, are too small to be seen by any microscope, and are, therefore, called "ultramicroscopic." They are also termed "filterable," because they can pass through the extremely minute pores of a Berkefeld porcelain filter.

The diseases caused by micro-organisms are further divisible into the acute or short-time diseases, which in many cases are definitely self-limited in their course, so that we can reckon their duration by days or weeks. Thus, the pneumococcus causes a pneumonia which lasts but a few days, which often ends abruptly by what is termed a "crisis."

The typhoid bacillus, on the other hand, causes a fever which lasts for several weeks, and ends gradually by what is termed "lysis." Infections, again, which are chronic in their course, such as tuberculosis and syphilis, are not self-limited or else they would not be chronic.

CLASSIFICATION OF INFECTIONS

The term "infectious" should be applied to all diseases caused by the entrance of a micro-organism, but the infections by them occur in a variety of ways. In some the infection commonly occurs directly, that is, by mere proximity of the healthy to the sick, such as small-pox, scarlet fever, and measles. To this class only should the term "contagious" be applied, though this term implies that the disease is propagated by actual personal contact, which may not be the case. Yet it is sufficiently applicable, if by it is understood that the disease is communicated by mere proximity. Such diseases, therefore, can be prevented by quarantine.

The second class are those by which communication is indirect through some intermediate agent. The discovery of these intermediate ways of communication is often of the highest advantage to the community, the knowledge of which would have prevented many disgraceful panics, when localities are invaded by them in epidemic form. Thus, Asiatic cholera is not contagious, for it does not spread directly from person to person, but only by swallowing some carrier of its germs like infected water or articles of food or drink, such as milk, which has become infected by its germs. The same is true of typhoid fever, which may be suspended in the drinking-water of a town.

The third class of infections should be called the inoculable, which enters the system through some wound or similar lesion of the skin or mucous membrane, such as hydrophobia, by the bite of rabid animals, or through direct inoculation by an insect, such as in yellow fever, and in the sleeping sickness of Africa and in all malarial fevers.

All that is claimed for this classification is that it defines the *usual* mode of communication, because all infectious diseases could be transmitted by direct injection of the infected blood, which method, however, is rare.

Besides the discovery of the ways by which the infections gain entrance into the body, it is important to know how they leave the body. This subject, however, will be best treated under the head of each disease, which only can conveniently give its details. It is important, however, to note the curious fact that though a patient may have recovered from an attack and thereby have become immune against its return, yet he may for long periods of time carry the specific germs of the complaint, while so immune, and thus distribute them to others. Thus, typhoid fever rarely attacks the same person twice, but lately we have discovered that many typhoid patients after their recovery will carry the typhoid germs for months or even years, which they can communicate to others by means of urine or other secretions.

In every infection the outcome will depend upon the balance between two opposing factors, the first being the power of the infecting organism itself, and the second the vital resistance of the body infected.

To the infecting power the term "virulence" is given, and this is often subject to marked seasonal variations. Thus, in one year a given epidemic may be very severe in its incidence and in the complications which it occasions, while in another year it is much milder in both these respects.

In an epidemic, also, the cases which occur at the beginning or during the height of an epidemic are usually worse than those happening during its decline.

Thus, during a winter of my service at the Roosevelt Hospital, 30 cases of epidemic cerebrospinal meningitis were admitted, of whom of the first 16 all died except 2; of the remaining 14, all lived except 2, while the treatment of both classes was the same. The explanation of the difference was that the first class was taken sick during the beginning or the height of the epidemic, while the second class came during its decline. These facts should be borne in mind when estimating the efficacy of any special line of treatment, for we ought first to know at what period or season the epidemic occurred.

In all these respects the infecting organisms behave like all seeds, some fall by the wayside where they cannot grow, and therefore come to nothing. In another individual his soil produces thirtyfold, and he is made correspondingly sick; in another it produces sixtyfold, and is much more sick; in another the yield is a hundredfold, and quite enough to kill him.

We find, however, that we can increase or diminish the virulence of these agents by certain changes in their environment. Thus, overcrowding or deficient ventilation or poor food tend to increase virulence, while it is decreased by the opposite measures.

It is important to know that very generally multiple or mixed infections occur. Hence, it should be the aim of every physician to keep the infection single, for if he does this, even the worst of them, like tuberculosis, may become comparatively mild infections. The tubercle bacillus has no liking for fresh air and is killed by direct sunlight in seven minutes, but in the cavity of the peritoneum there is neither air nor light, and here this bacillus may produce extensive changes, so that the surgeon on opening the abdomen finds the peritoneum abounding with tuberculous masses, which, however, then get well spontaneously. The explanation is that the infection has occurred all alone, and that it has become much weakened by its brief exposure to light and air, so that the vital resistance of the patient is sufficient to put an end to it in its enfeebled condition. In like manner tuberculosis occurring in bones is not commonly disseminated through the system, but in the lung the tubercle bacillus finds hosts of allies in the shape of the pyogenic cocci, which cause this original single infection to become the scourge of the human race. A good illustration of multiple infections happens in small-pox, in which disease we may have three distinct infections. The first is that of the small-pox agent itself, which has not yet been identified. Its onset is usually sudden, accompanied by high fever, headache, and pains in the back and limbs; the stomach also becomes very irritable and the tongue coated. On the fifth day a great change for the better occurs; the fever drops, the pains subside, the tongue cleans, and the stomach becomes so quiet that the patient may be hungry and want to eat. But by that time the eruption of small-pox begins on the skin in the form of hard pimples, each tipped, however, by its specific little vesicle. To this vesicle all the disastrous subsequent symptoms are due. Thus the surgeon, before he attempts to cut through the skin, disinfects both his instruments and his hands in order to prevent the entrance of the pyogenic cocci, which always swarm upon the cutaneous sur-

face. Now, what the surgeon is so careful to prevent, the small-pox vesicle allows to happen, so that the original pimples fill up with pus and soon change the case into one of virtually surgical pyemia. If the patient has not been vaccinated before, the pyemic infection becomes far worse and changes the case into confluent small-pox, but if he has been vaccinated the eruption may be only single and scattered, when it is often called mild varioloid. In view of these facts, to call a noisy opponent of vaccination an ass is unfair to that useful quadruped, for he often shows more intelligence than his biped rival when he brays against the most universally harmless inoculation in the world.

The third form, or malignant small-pox, is fortunately uncommon. In this the patients may die before the eruption appears, but in no other form is the disease so dangerous, for many fatal cases have occurred in persons who unwittingly attended the funerals of these patients. All that is found is a remarkable infection of the blood by vast numbers of streptococci. How these enter we do not know, because small-pox is not due to a streptococcus, else it would have been identified long ago.

These principles find also special applications in scarlatina and in diphtheria. In scarlatina the first thing that happens is an inflammation of the throat and tonsils. This prepares the way for the entrance into the blood of great numbers of streptococci, to which most of the fatality of this disease is due. Diphtheria often attacks the throats of patients sick with scarlatina, so that we have these two infections simultaneously. But diphtheria is at first a purely local affection, its membranes secreting the toxin which, absorbed into the blood, causes all the serious symptoms. Meanwhile, if the diphtheric exudation extends deeply enough it is apt to become gangrenous and ulcerated, whereupon absorption into the system of streptococci occurs on a large scale. Owing to the practical importance of the subject, I would here relate a case of this kind which I saw in consultation with Dr. Geo. Ferguson, of the Bronx Borough of New York, in a child five years old. The girl first had an attack of typical scarlatina, but on the fourth day diphtheria set in, a membrane forming, and spreading so rapidly that when on the seventh day I saw the patient the exudation had hidden both the tonsils, the uvula, and the pharynx. The glands of the neck on both sides were greatly swollen, the patient could not swallow, and the breath had a gangrenous odor. I told the physician that it was useless to administer any medicine, first, because the girl could not swallow, and, second, because we had no medicines against the exanthemata. I, therefore, directed that we should wash

out the throat as we would clean a dirty sidewalk with a hose. A fountain-bag, containing 2 gallons, was suspended 6 feet over the head of the child, and a steady stream of hot water with a teaspoonful of chlorate of potash and 5 drops of oil of peppermint to the gallon was poured into the throat, the mouth being kept wide open so that none of this douche should be swallowed. The result was that this douching every two hours brought away immense quantities of the membrane, and after keeping up this douching for six days and nights the child perfectly recovered. Now what was accomplished in this case was that both the exudate of diphtheria and the infection of the streptococci accompanying the scarlatina were washed away as soon as they began to accumulate, while the child's vital powers finally carried her through, when they could work without every moment a fresh infection occurring.

The original seat of an infection may be wholly local. We have examples of this in diphtheria and in Asiatic cholera. The diphtheria bacillus does not enter the blood, but usually first grows and spreads its exudative membrane in the throat and adjoining parts, and from these surfaces its virulent toxin is absorbed into the circulation, hence the practical importance of washing the infected mucous membrane clean. But this also applies to all infections which begin with angina or sore throat like scarlatina. The cholera vibrio likewise does not enter the blood, but grows exclusively on the mucous membrane of the small intestine, whence its toxin is then absorbed. Unfortunately, because of its location, we cannot wash it away.

Local infections may very commonly be disseminated by metastasis, by which term is meant transference of the infecting agent from its primary seat to other places in the body either by the blood or by the lymphatics. A striking illustration of this is found in many cases of pyemia.

The knowledge of the ways by which infectious micro-organisms leave the body is of great importance for prophylaxis. Some of them leave by discharges of the pathologic products which they have caused, while others leave the body by secretions from the blood or from the mucous membranes, as, for example, from that of the nasopharynx in diphtheria and meningitis, or from the bronchial tract in influenza, whooping-cough, or tuberculosis, or from the intestinal mucous membranes in typhoid fever, cholera, and bacillary dysentery. The aim of the physician, therefore, should be to destroy the infecting agents by dealing at once with these dangerous discharges, as will be noted under the head of each disease.

CHAPTER II

AFFECTIONS DIRECTLY COMMUNICABLE OR CONTAGIOUS

ACUTE INFECTIONS DIRECTLY COMMUNICABLE OR CONTAGIOUS

PLAGUE OR PESTIS

THIS is much the most anciently known and destructive of diseases communicable to man. Its characters are so peculiar that we can have little doubt as to its identity throughout the accounts of its occurrence in the literature of all countries during the many centuries of its prevalence. In one pandemic, occurring in 1346, it is estimated by Hecker to have destroyed 25,000,000 people, although Europe was then comparatively very thinly populated, and its fatality has not at all diminished, for the reports of the British Government of its prevalence in India during the years 1905 and 1906 show that relatively to the population the death-rate is as high as it ever was.

It is also the most anciently known to us of all epidemics, and is plainly mentioned in the fifth and sixth chapters of I. Samuel in the Bible. Commentators who are not physicians have doubted the identity of this great plague among the Philistines with the specific epidemic known throughout the centuries, but physicians can readily recognize this Biblical reference in the statement that it was accompanied by tumors, and that it had something to do with rats, so that to propitiate the angry God of Israel the Philistines sent along with the ark golden representations of tumors and also golden rats. The word in Hebrew translated "mice" also applies to rats. But it was not until our day, thirty-five centuries after the Biblical reference, that Kitasato identified the propagation of the plague through the bites of fleas which had been living on plague-infected rats.

How the ancient Philistines came to suspect that rats had anything to do with the plague is very natural to infer from the fact mentioned in all histories of this disease that it precedes or coincides with a fatal epidemic among rats, producing veritable buboes in them, especially in the axillæ and groins. The cause of this epidemic, so fatal that it has been termed "the plague," is the *Bacillus pestis*, first identified by Kitasato, who was deputed by the Japanese government in 1894

to investigate the disease during an outbreak in Hong-Kong. Kitasato found numerous bacilli in the buboes, heart-blood, liver, and spleen. Similar bacilli were also found in a living case of plague on the same day. All the animals inoculated by Kitasato died with signs not differing from those of human bubonic plague, except pigeons and other birds.

The plague bacillus as found in the buboes and blood shows a considerable polymorphism, of which two forms may be readily recognized, namely, short oval rods, which are non-motile, but take on a high degree of polar staining, the micro-organism appearing stained at the ends, but not so in the middle.

Pure cultures kept in the dark and prevented from drying can live for many months, and are but little affected by their surroundings becoming putrefied. In fresh water the bacillus has been found to exist so long as twenty days. Marsh found that the bacillus could live for months in sterile cow dung. The only active general agent against these plague bacilli is light, exposure to which, according to Kitasato, kills the bacillus in less than three hours. Exposure to cold has very little effect on the plague bacillus. Thus, Gladin froze and thawed cultures daily, and the bacilli were still alive after forty days of such treatment. It is comforting to know that our usual chemical disinfectants are very effective against the plague bacillus. A 1 per cent. solution of corrosive sublimate kills the bacillus at once, a 1 per cent. solution of carbolic acid kills it in five minutes, and a 1 per cent. solution of calcium chlorid kills it in ten minutes.

There is no pathogenic organism which seems to have such power over the great majority of vertebrates. So, unlike the typhoid fever bacillus, which can only affect human beings, the plague bacillus causes rats, guinea-pigs, and monkeys to succumb in a few days after the inoculation of very minute quantities of plague material, even bats being highly susceptible. In other cases, as in the horse, dogs, cats, sheep, cattle, goats, and pigs, inoculation produces fever or the formation of a local bubo ending mostly in recovery; birds, on the other hand, show a high degree of immunity.

It has been clearly demonstrated that the chief source of the plague in human beings is from fleas which have bitten rats sick with the plague. This has been particularly proved in the case of ship rats, and explains why the plague is so often introduced to a country from its seaports. It is one of the many benefits conferred by science on mankind that these facts promise to rid the world of this dangerous epidemic, because in every civilized country now measures are taken

to exterminate rats, when, as in the case of ships, they are the means of transporting the plague. This was done in California, when the plague was introduced there by Chinese immigrants; but it was then discovered that squirrels and other rodents were equally liable to be infested. By such prophylactic measures this once formidable epidemic is nearly extinct, except in some quarters whose inhabitants are not sufficiently civilized to coöperate with the authorities in combating the disease. This has occurred in India, where an ignorant opposition on the part of the population has embarrassed the British officials.

From what has been stated, it is evident that in one sense the plague is not contagious, for if a man is infected he can communicate it to others only by means of fleas. Unsanitary conditions have no relation to the occurrence of plague excepting so far as they favor the multiplication of rats. This disease, as might be expected, occurs in several forms; the first is a mild form, the *pestis minor*, in which the patient may not be ill enough to seek medical relief, having only a few swollen glands in the groin, but he still is a serious danger to others, as his urine and feces will contain the bacilli.

Much the commonest form is what is called the *bubonic plague*, which begins with headache, backache, stiffness of the limbs, restlessness, and great depression of spirits, with a fever steadily rising to high figures, until the evening of the third or fourth day, when there is a drop of 2 or 3 degrees, and then the fever rises again, perhaps to a still higher point, the tongue becomes brown, and collapse symptoms are apt to supervene, followed by death. Meanwhile, glandular swellings of buboes make their appearance, which have given the name to the disease. In over 50 per cent. these buboes appear in the groin from the third to the fifth day. If suppuration occurs it is regarded as a favorable feature. Meanwhile petechiæ, or subcutaneous hemorrhages, rather commonly show themselves, and are usually dark in color and may become extensive. It was this symptom that gave it the name of black death in the Middle Ages. At this time hemorrhage from the mucous membrane may also occur, including hematemesis. One form is called the *septicemia plague*, which is merely most rapid in its course, for the patients may succumb in three or four days before the buboes appear.

Lastly, there is the *pneumonic plague*, one of the worst of them all, having every clinical feature of pneumonia, usually lobular, when the sputum contains the bacilli in enormous numbers. The mortality has been so great that in some places only 3 out of 100 survived.

Treatment.—Little can be done in such an acute disease other than by the local treatment of the buboes. Ice may be applied to them, and some good results are reported from injection of bichlorid of mercury. More hope can be placed upon a plague serum made by Yersin, but it must be employed very early, if possible on the first day. On the other hand, Haffkine's serum is used as a preventive, by which, according to C. J. Martin, the chances of subsequent infections are reduced four-fifths, while the chances of recovery are two and one-half times as great as in the uninoculated.

SMALL-POX

The origin of this disease is of unknown antiquity, for it evidently prevailed in China some centuries before the Christian era, and then spread through the world as a true pandemic for many centuries. Razes, an Arab physician of Bagdad, living in the tenth century, spoke of it as a disease from which no one could be regarded as exempt. Subsequent writers speak in the same strain. For a long time it was regarded as a special disease of children, so that some reputable medical writers stated that those who apparently escaped infection did so because it was forgotten that they had had small-pox in childhood. Considering its frightful mortality, accompanied by such repulsive features during its course, we are now scarcely able to appreciate the importance of Jenner's discovery in 1796. Not only does vaccination prevent great epidemics of small-pox, but it modifies the disease when that occurs in vaccinated persons to such a degree as to cause so mild a development that it is termed "varioid." It should be remembered, however, that a person with varioid can convey the infection to an unprotected person in its severest form. Experience on a large scale has also demonstrated another important fact, namely, the importance of revaccination. Statistics in the Prussian Army, in which those who report for service every five years are at each time revaccinated, show that three vaccinations are a better protection than an attack of small-pox itself. As revaccination is compulsory in Germany, the results are striking. In Munich, with a population of nearly 550,000, though the city hospital has 1320 beds, only 14 are set apart for small-pox. In Dresden, with a population of nearly 520,000, there have been no small-pox deaths for ten years.

Owing to human perversity or to mental enfeeblement there have developed, especially in England, local epidemics of antivaccination, such as in the towns of Gloucester and Leicester, with the result

that small-pox has attacked those localities in epidemics with all its pristine vigor and fatality.

Clinical Course.—As we have remarked before in treating of mixed infections, we have three separate diseases in the course of small-pox. After an incubation period averaging from twelve to fourteen days, during which the patient seems to be in good health, he is suddenly attacked with vomiting, accompanied in adults with a severe chill; in children often with a convulsion and rapidly developing fever from 103° to 105° F. Violent headache then sets in, and with it a diagnostic backache. No other infectious disease is accompanied with such backache. This initial attack may, in a few cases, be severe enough to cause death. About the third day the characteristic eruption begins to appear in the form of minute hard pimples, which give what is called a "shotty feel" under the skin. With the appearance of this eruption the severe symptoms subside and the temperature falls. The tongue, which has been previously thickly coated, becomes cleaner; the stomach, which has been so irritable that scarcely anything could be retained, now not only becomes quiet, but the patient may actually be hungry and feel generally so much better that he thinks he is getting well.

Then commences the *secondary stage* of the disease, usually about the fifth day from the initial symptoms. The papules enlarge, and on the tip of each a small, clear vesicle appears, which greatly facilitates the diagnosis by being umbilicated, a feature present in no other eruption. This umbilication consists of a central depression in the vesicle.

Soon after this a wholly new and secondary infection of the papule occurs, because this latter enlarges and becomes globular, due to the infection of the eruption by the streptococci and staphylococci, which always swarm upon the skin. As previously stated, the surgeon never ventures upon a cutaneous incision without the utmost precautions in the way of disinfecting the skin, because of this same infection by the pyogenic organisms constantly present on the surface. What the surgeon thus attempts to prevent, the small-pox eruption actually causes to occur. There can be no doubt that this secondary infection of pyogenic organisms is due to the specific action of the initial small-pox vesicle, and in proportion to its virulence will be the secondary invasion, leading in many cases to confluent instead of discrete small-pox. Soon after the beginning of this secondary invasion the whole clinical course of the disease is changed. The temperature rises, and the patient presents the appearance of a virtual general septicemia.

But a third and a more serious infection occurs, aptly termed *hemorrhagic, malignant, or black small-pox*, which frequently causes death before the characteristic eruption appears. We may, therefore, as well describe its symptoms and course now. The attack usually begins with the same symptoms accompanying the initial infection, only they are more severe, in the form of vomiting, and particularly in the diagnostic backache. Instead of the eruption, however, purpuric subcutaneous hemorrhages appear, at first in scattered locations, but rapidly enlarging and running together. I see no advantage in dividing up the initial hemorrhagic lesions into several varieties, because they all have in common the distinctive feature of subcutaneous hemorrhage. Certain parts of the body, however, are especially involved, affording an absolutely pathognomonic appearance. This is marked by a broad-based triangle with its apex at the pubes, or little lower, and its base, including the whole area below the umbilicus, bounded by a line drawn from the iliac spines. The whole surface of this triangle assumes a leaden color which persists after death. Elsewhere there may be extravasations of blood under the skin, such as about the axillæ, which occasionally show some raised papules, but with the same distinctive features of purpuric subcutaneous hemorrhages remaining. The face may be swollen, but the distinctive feature is hemorrhage into both the palpebral conjunctivæ and its reflection on the eyeball. This causes the eyes to look as if they had been blackened, an appearance found in no other disease. Meantime, the constitutional symptoms are the gravest. The pulse becomes very weak and rapid, and the patients sink with all the symptoms of vital prostration, death occurring sometimes within forty-eight hours from the beginning of the disease, while in other cases life may be prolonged from three to six days. It is remarkable that the mind is so little affected; it may remain clear to the end. The only distinctive change in the blood is the presence of an intense streptococcemia, the origin of which is wholly unknown. One of the worst features of this form is that due to the absence of the specific eruption of small-pox; the proper diagnosis may not be made, and, as the infection remains virulent after death, many cases are reported of persons becoming infected from attending the funerals of such patients.

We now return to the symptoms marking the course of *ordinary pustular small-pox*. If the attack is not very severe or confluent, the eruption is accompanied by considerable swelling of the skin extending from the pustules, swelling of the cervical lymphatic glands, and with it so much itching that the patients frequently rupture the pocks

by scratching them, producing open, running sores, which, becoming further infected, scabbing commences, with a formation of more or less extensive crusts. If upon the face, they are as thick as sand; it is no advantage to have them few and far between on the rest of the body. Throughout the third week the desiccation proceeds, and in cases of moderate severity the secondary fever subsides, but in others it may persist until the fourth week. On the fourth week the scabs fall off singly, but cases have been reported of the whole epidermis of the hands and feet separating. The material of these crusts when dried is highly infectious. The peculiarity, however, is that the pustules are larger and more ulcerated on the face, backs of the wrists, and hands; in other words, in places exposed to light and air. Under the bed-clothes they are frequently discrete and much smaller in extent. This fact affords a hint of much use in treatment, as we shall describe.

In confluent small-pox all the symptoms, both local and general, are more severe; the swelling of the face and of the eyelids may completely obliterate the features, and the hands and fingers, which from the beginning show a stiffness in flexion, may become so swollen by the eruption that the fingers are kept wide apart, presenting a repulsive appearance. The cutaneous ulceration is very apt to leave its scars on the face for life. In my experience at the New York Quarantine Small-Pox Hospital I found that these disfiguring marks by scars could be prevented by painting the whole face with a saturated solution of nitrate of silver. Silver nitrate has no penetrating power, because it immediately forms an insoluble albuminate of silver with the discharge of the eruption, which prevents its deeper penetration, thus forming a complete mask which excludes all light and air. When this application was made the patient said it felt very cooling, but it turned them all into the like of Ethiopians from the blackening of the skin. After the disease had subsided this protective mask peeled off, leaving nothing but the temporary hyperemic appearance of the skin, which in time disappeared, with no scars remaining.

In malignant small-pox, hemorrhages from the mucous membranes may take place, causing hemoptysis.

The eruption of small-pox may occur within the mouth itself, and then cause death by sudden edema of the glottis, which happened to a patient of mine in the small-pox hospital.

In confluent cases very troublesome carbuncles follow during convalescence. These are best treated by sprinkling the ulcers with chlorate of potash in powder, which, although smarting, prevents deeper extension of the ulceration. In all cases of small-pox eruption in the

mouth I would have them rinse the mouth as frequently as possible with a saturated solution of chlorate of potash.

Meantime, from the earliest stage of the pustular eruption, we should sustain the strength of the patient by the administration of 12 gr. of quinin in three divided doses during the day, conjoined with 15 gr. of calcium lactate.

SCARLET FEVER (SCARLATINA)

No disease varies like scarlatina in the severity of its incidence in different patients, owing to their constitutional peculiarities of unknown origin. These variations, however, are not in the agent itself, because the mildest cases can communicate to others the disease in its severest forms. Thus, in one patient scarlet fever can be so mild that its presence may be wholly overlooked, but this patient can communicate it to another, who quickly succumbs to that form called scarlatina maligna.

The agent itself of scarlet fever is yet unknown, but by means of the angina of the throat which it causes, it so quickly infects the system with an invasion of streptococci that by many writers it has been confounded with them, so that different strains of streptococci have been erroneously identified as the primary and causative agent of the disease. Likewise scarlatina, like other acute infections, prevails in an epidemic form of varying severity in different seasons.

The origin of this disease is not known historically, and we owe to Sydenham, in 1675, its first differentiation from measles, with which it had been previously confounded. Its prevalence, however, is chiefly limited to the temperate zones, so that it is rare in tropical countries. Practically, the most important fact about scarlet fever is its quick but secondary complication with the virulent streptococcal infection, which may be of such a severe type that the patient soon succumbs from a condition closely resembling hemorrhagic small-pox, before the time for development of its specific eruption. These cases have been confounded with hemorrhagic small-pox, just as this disease itself has been mistaken for scarlatina. As we have shown, both these diseases are characterized by intense streptococcemia.

Symptoms.—This disease usually sets in with vomiting, and in some children with a convulsion. Along with the vomiting, fever takes place, which may rapidly rise to 103° F. or above. Sore throat is simultaneously complained of, and the throat should be carefully inspected then and afterward at every visit. Usually in a few hours the eruption appears, first on the chest and then on the neck. It

then becomes especially marked in the folds of the axillæ and afterward in the groins. By the second or third day it has spread over the whole body, from above downward. One peculiarity is that, unlike measles, it does not appear on the face, which, instead, may show a bright flush on the cheeks, but accompanied by one symptom which is almost pathognomonic, and that is the ring of paleness around the mouth, sometimes accompanied with a small herpetic eruption at the junction of the lips. The eruption of scarlet fever, when typical, is easily recognized on account of its punctate appearance. But, when general, it is often difficult to distinguish it from numerous other scarlet rashes. It is then that the appearance of the tongue is so distinctive. On carefully examining the tongue, its tip and edges near thereto show prominent highly injected papillæ. The tongue at first is covered by a white fur, but through it appear, projecting, the inflamed and enlarged papillæ. Even when the tongue has desquamated these papillæ remain distinctly swollen and inflamed, giving origin to the name "strawberry tongue." The value, for diagnosis, of this condition is because no other form of sore throat is attended with such an appearance of the tongue. In some cases, though the appearances of the tongue and throat are characteristic, yet the cutaneous eruption is not distinct, so that the term "*scarlatina sine eruptione*" is applied to such cases. At the same time the tonsils are greatly inflamed and occasionally covered with a grayish pellicle which may be confounded with a diphtheric exudation. The arches of the palate likewise look very red, and the uvula is often edematous. The punctate eruption may also develop on the roof of the mouth. Normally, the skin on the posterior surface of the upper arm presents numerous papule-like elevations. These, in the second week of *scarlatina*, become both enlarged and inflamed, so as to constitute a valuable diagnostic appearance. In its further course, ulceration in the throat with swelling may begin, and extend sometimes, with great destruction of tissue, to the contiguous parts, rendering swallowing difficult, and accompanied sometimes with a regurgitation of fluids into the nose. This form is sometimes called *angina ulcerosa*, and is characterized by persistent vomiting. In more favorable cases, the throat, though severely inflamed, is not subject to destructive ulceration. When it is, however, the lymphatic glands of the neck soon become implicated and swollen, so that they may appear like a collar encircling both sides of the neck. Occasionally suppuration takes place in these glands. Meanwhile, the nose becomes involved, and a profuse discharge or rhinorrhea occurs, which adds greatly to

the distress of the patient. This rhinorrhea may remain infective for weeks after the subsidence of the disease, which is to be explained by the fact, already noted, that in a number of infections the patients continue to carry about the germs of the disease for prolonged periods after they have recovered from the first attack. Thus, after typhoid fever the infected patient may be the carrier of typhoid germs even for years after his recovery from the primary attack. Every patient after scarlet fever, with a discharge from either the nose or ears, may be capable of infecting others in this manner.

Concomitant with the affection of the throat, and naturally depending upon the extension of the inflammation up the Eustachian tubes, we have a purulent inflammation of the middle ear. This may occur so early that the first sign of it may be a purulent discharge from the middle ear. The physician should always be on the watch against this complication, because it is estimated that 20 per cent. of all cases of deaf and dumb children are due to the destruction of hearing by this scarlatinal otitis. One sign of its onset is a sudden rise of temperature and, in smaller children, crying from pain, with the hand brought to the ear.

Incubation.—Like other infectious diseases, the period of incubation varies in scarlatina. The rule, however, is that it is shorter than in any other exanthem. Well-authenticated instances of an incubation period of only three days are numerous. Murchison vouches for a case, in his experience, in which the incubation period was only eighteen hours. On the other hand, numerous observers, who pay particular attention to this subject, recount cases where the incubation varied from seven to twenty-one days. A physician may be naturally questioned by the relatives of a child who has been exposed to scarlatina, how soon it may be expected that he will show the first signs of an onset. The reply should be that, if a week has passed, it is unlikely then to develop, but there are exceptions to this rule.

The **pulse** in scarlet fever, to a trained observer, is quite characteristic, being not only small, but also of high tension from the very beginning, and hence is of importance in diagnosis; this condition not being found in any other infective fever. Its frequency in children usually corresponds with the height of the fever, and may be from 160 to 200 per minute.

Desquamation.—This begins often with a peculiar pin-hole appearance, coupled with a very dry feel of the skin. On the face it may be just like the bloom of a peach, and is called *furfuraceous*. The desquamation commences in severe cases in four or five days from

the beginning of the attack, though in mild cases it may be much later. It is most pronounced in the axillæ and the groins, consisting of lamella scales, whose size greatly varies in different cases, being smaller in young children, and larger in adults. In the palms and soles of the feet it occurs the latest of all, but also in the largest patches. An early sign of desquamation, which may be of use in diagnosis, is the appearance of a white line at the junction of the pulp of the finger with the nail, looking very much as if a fine superficial incision had been made. To reveal this the pulp of the finger should be pulled away from the nail.

Infectivity.—No subject is of so much importance in this fever as its periods of infectivity. However early recognized, it has already become infective, though it usually is mostly so when the eruption is well out and the fever high. Nothing, however, can be more vexatious than to determine when the patient is no longer capable of communicating the infection. The rule is that a mild case should be isolated for six weeks, and severe cases for double that length of time. Cases with discharge from the nose or ear may remain infective for three months. This question cannot be decided by the disappearance of all signs of desquamation, as is shown by the return cases of patients who have been discharged from hospitals, apparently quite well, and then who have communicated the disease to others at home, so that not even the most careful precautions will insure the cessation of the power of infection for any number of weeks. This question becomes a very practical one when the physician is asked how soon after scarlet fever a child may be allowed to go to school. The rule is that for mild cases the isolation need not be more than six weeks.

Unlike other exanthemata, scarlet fever in a patient does not infect others who are only a few feet from him. There is no such thing as aerial infection, as is so markedly the case in small-pox. A child, therefore, taken with scarlet fever in a house, can be at once isolated in a room and kept there during the whole period of his sickness, without others of the family contracting the disease. But though this is happily the case, unfortunately the contagion may cling for an indefinite time to articles of clothing, particularly if they are folded and packed away in trunks. Many cases are reported in which such articles have infected persons a year after they have thus been removed. It should be remarked that this agent, like that of tuberculosis, cannot bear sunlight, and hence all the clothing and bedding of these patients can soon be disinfected by outdoor exposure to the sun. Disinfection of the room in which the patient has been ill can be effected

only by tightly closing it and burning formaldehyd, all persons being excluded.

The **complications** of scarlet fever are numerous. First we would put the occurrence of pneumonia, usually the bronchopneumonic form. In my experience 20 per cent. of the patients with scarlet fever suffer from this complication. I ascribe this largely to the inhalation of infected particles during the struggles caused by the swabbing commonly resorted to for the treatment of the inflamed throat, and is not so apt to occur when the throat is douched, as will be described presently. Next to pneumonia comes pleurisy, which is particularly dangerous in children on account of its leading to empyema. After pleurisy comes arthritis, or so-called scarlatinal rheumatism. This affection but rarely causes suppuration in the joints. If so, the prognosis of the case depends upon whether, as in pleurisy, the pus contains streptococci, when the management of the case becomes much more difficult. Ordinarily, the joints recover without any lesion remaining. In scarlatinal rheumatism, however, and often without it, endocarditis may develop. The heart is very commonly affected in the course of scarlet fever, being often, as in ordinary rheumatism, dilated from the softening of its walls, with the production of apex systolic murmurs.

One of the most serious sequela is scarlatinal nephritis. The kidneys may be congested temporarily at the beginning of the fever, similar to the same condition in other infections, but it takes on a special form, which occurs late in the disease, coming on in the fourth week or afterward. This may begin as a glomerular nephritis, soon becoming tubular, and finally interstitial, and is apt to occur in mild cases as well as in severe. An early sign of this nephritis is a general edema, and, with it, a diminution in the amount of urine that may lead to total suppression, the urine first becoming bloody. In my experience the prognosis of such cases is not necessarily fatal, because I have succeeded in re-establishing the flow of urine after it had been suppressed for two days, and the patient lay in coma after one or more convulsions. In other cases the urine flows freely, and contains only $\frac{1}{10}$ of 1 per cent. of albumin, but the patient may suddenly have a convulsion and die. Often scarlatinal nephritis is followed by chronic interstitial change in the kidneys, from which recovery never takes place.

Treatment.—As regards treatment, I would put in the forefront the immediate recourse to douching of the throat. This cannot be begun too early, as the indication for it should be clearly understood,

that the inflammation of the throat, caused by the fever, allows of a most free entry into the circulation of virulent streptococci, to which the chief dangers of the disease are due. We should, therefore, regard the case as one of local disorder at first, but quickly leading to the most serious general infection. Therefore it should be treated locally with the only really effective measure which we possess. As soon as the diagnosis is made, I direct that the child's mouth should be kept wide open by an efficient rubber plug inserted between the front teeth. A fountain-syringe, holding 2 gallons of hot water, is then suspended 5 or 6 feet above the child's head, and the stream of hot water made to run through the tube carried to the back of the tongue. So long as the mouth is kept wide open the child cannot swallow any of the fluid, nor can any of it pass into the nose. With the patient holding the head over a basin, the stream of water impinges first on the posterior walls of the pharynx, and returns past the tonsils, thus washing them clean and bringing away great masses of throat secretions. In a short time the patient experiences such a relief from this douche that he does not offer any resistance. In the 2 gallons of water 2 teaspoonfuls of chlorate of potash and 5 drops of oil of peppermint should first be dissolved. One sign of its efficiency is that the swollen glands in the neck begin promptly to subside, and the painful deglutition owing to the throat ulcerations similarly improve, so that the patient can take nourishment. From my experience I have no doubt also that early recourse to this douche will obviate the ears becoming affected. This douche at first and in severe cases may be repeated every two hours.

The next indication is to stop the vomiting, which in bad cases may be very protracted. For this purpose 1 gr. of calomel, rubbed up with 20 gr. of white sugar and divided into six powders, should be administered, one powder every ten minutes, the powder simply being laid on the tongue. I would repeat this calomel treatment every day for three days or until the tongue desquamates, after which it may be discontinued. Otherwise the case may be left to nature, for having prevented complications, the natural powers of the system for resisting infection may be safely relied upon.¹

In scarlet fever we particularly note the great relief caused by oily inunctions of the whole body. For this purpose we may use the "linimentum aqua calcis," applied warm, with $\frac{1}{2}$ dram of oil of cinnamon to the pint, to give it a pleasant fragrance. This application greatly allays the restlessness caused by the cutaneous inflammation, as well as reduces temperature. In the kidney troubles, which in

¹For *Diarrhea*.—℞. Calomel, 3 grs.; white sugar, 20 grs. Divide into 6 powders. One powder every ten minutes until all are taken.

my experience do not occur if the douching has been thoroughly employed, diminution and suppression of urine is best treated by 1 to 2 gallons of normal saline solution poured into the rectum by means of Kemp's rectal irrigator, the best instrument for all forms of deficient renal action that we possess. Should suppression, however, already have taken place, counterirritation should be applied in front, over both kidneys, in a way suggested by Brown-Sequard. Tablespoons are immersed in boiling hot water and then quickly touched on the abdominal surface in three or four places on each side. I once restored a patient who had had suppression for two days, and then a convulsion, after which he was pronounced dead by a physician who had been called in, but on the last application of the hot spoons he opened his eyes and soon passed some bloody urine. Fifteen years afterward he sent me his wedding cards.

MEASLES

Measles is due to a highly contagious infection which prevails over the whole world. Its causative agent has not yet been identified, nor do we know of its first appearance in history, but its first introduction into certain parts of the world is often very definitely known. It is highly communicable.

Clinical Course.—Some days before the rash appears on the surface there has already occurred very characteristic symptoms of coryza, suffusion of the eyes, lacrimation, nasal catarrh, and acute bronchitis. Previous to the skin eruption an eruption also takes place in the mouth, which is very distinctive, consisting of reddish spots, tipped by a minute bluish-white exudation, called after Dr. Koplik, of New York, who gave its first accurate description, though it had been noted before by other observers. These spots are found especially upon the buccal mucous membrane and on the inside of the lips. They generally appear two or three days before the eruption, though occasionally not until the cutaneous eruption appears. They thus constitute a valuable means of diagnosis, because measles is highly communicable during the period of its catarrhal symptoms, and hence the disease spreads while it is not yet suspected until the rash comes out on the face. Measles is probably carried by the air, but not *commonly*, differing thus altogether from small-pox. It does not, like scarlet fever, infect a room or its belongings, susceptible children being allowed safely to enter an apartment where a patient has been sick with it shortly before.

The period of incubation of measles may be set down as about

eleven or twelve days after exposure, and then begins with the symptoms of a bad cold. The rash first appears as minute pimples at the roots of the hair. These coalesce in the form of very characteristic crescentic reddish spots, which then rapidly spread to the temples, to the rest of the face, behind the ears, and then progressively over the trunk and down the lower extremities, appearing upon both the flexor and extensor surfaces, and well marked on the backs of the wrists, the palms of the hands, and the soles of the feet. At first the spots are of rose-red color, but in time become less bright, shading into purple. In some cases the papules are larger and have a distinctly shotty feel, so that they may be mistaken for small-pox. A very dangerous form of measles is characterized by actual hemorrhage into the skin, which so darkens the spots as to give rise to the term *black measles*. In different epidemics it may be either very transient or unduly prolonged. The eruption usually appears on the third, fourth, or fifth day after the catarrhal symptoms begin. Eruption is more intense if the patient is kept warm in bed. It is delayed by external cold, and is hastened in its appearance by a warm bath. Occasionally, in weakly children, the rash fades from heart failure, when hot baths and internal stimulants should be immediately resorted to. The usual time for the eruption to appear is the fourth day after the first catarrhal symptoms. At this time there is apt to be marked photophobia, and this affection of the eyes may persist for weeks. Epistaxis may also occur about the third or fourth day after the eruption.

So-called malignant measles, which we have already referred to, is fortunately rare. In this form the eruption becomes hemorrhagic, accompanied by high temperature, death being sometimes preceded by a rise to 107° or 109° F. Any sudden rise in temperature a day or two after the eruption is out may be regarded as an indication of some complication, such as pneumonia or otitis media. The duration of the fever after the eruption varies, but the rule is that it begins to decline after the third day, and reaches normal by the end of the week, in uncomplicated cases. Desquamation follows nearly every case of measles, but may be so slight as to escape detection. It usually consists of small bran-like scales and lasts from one to two weeks.

The **complications** of measles are numerous, the most important being bronchopneumonia, which is present in every fatal case. Next to pneumonia is pleurisy, which, however, is not so serious as pleurisy in scarlet fever. The throat in measles is very red and inflamed, the inflammation often extending to the larynx, with a croupy cough. It is due to this condition of the throat that otitis media develops, but

not at all as commonly as in scarlet fever. The next complication is diarrhea, which occurs very often, and early in the disease. One peculiarity, however, of the change in the skin produced by measles is a tendency to gangrene of the affected surface, such as does not occur in any other exanthem. I have known of 2 cases of fatal gangrene in children caused by the application of a mustard poultice during the initial stage of bronchitis. Some disturbances of the nervous system occur immediately after measles, but no more than in other exanthemata.

Treatment.—The mortality from measles themselves, in families well housed and with abundant air space, is so slight that a physician might regard this as a comparatively trivial disease. In a long general family practice I can remember only 1 death from measles, but the United States census report states that nearly 13,000 persons died from measles in one year, and in England the mortality is greater than in scarlet fever. But the reasons for this are that the severity of an epidemic of measles is greatest in crowded tenements or in hospitals for contagious diseases. In such circumstances measles acquire an increased virulence; the more crowded and confined the quarters, the worse the disease, and in all cases the mortality is not due so much to measles as to its complications. It is necessary to take the initial bronchitis in hand at once for the purpose of rendering the secretion very fluid and easily expectorated. For this I know of no agent equal to my linseed oil mixture referred to on page 316. It should be remembered that the bronchial tubes, whether large or small, should contain nothing but air. Every liquid secretion, therefore, in these tubes is virtually a foreign body, and if the secretion be viscid and thus difficult of removal, this fact suffices to explain the supervention of pneumonia in the lobules supplied by the occluded bronchioles. As young children are very deficient in the power of expectoration, this explains why general bronchopneumonia is so commonly fatal in measles.

From 1 to 2 teaspoonfuls of my linseed oil mixture should be given every three hours to a child under five years of age, and the cough will be relieved by the addition of $\frac{1}{4}$ to $\frac{1}{8}$ gr. of heroin, depending on the age. In other cases the liquor ammoniæ acetatis may be given or sweet spirits of niter with 10 to 15 drops of paregoric. When the cough is croupy, steam inhalations, with $\frac{1}{8}$ of molasses to the quart of water, should be kept up, for this is the best way of allaying laryngeal irritation, the steam being conducted under a tent over the child's bed. Lastly, the skin should be well oiled twice a day with the liniment of

aqua calcis, as recommended for scarlet fever. The eyes should be carefully attended to by appropriate lotions of boric acid, while the edges of the eyelids are kept from adhering by using a mixture of 3 parts unguentum hydrargyrum ammoniatum to 1 part of oxid of zinc ointment. So long as there is photophobia the patient should be kept in a darkened room. Should epistaxis occur, the child should be given 5 gr. of chlorid of calcium, which, on account of its irritant taste, is given three times a day in syrup. The diarrhea of measles is best controlled by calomel in the same way as prescribed for the diarrhea of scarlet fever.

RUBELLA OR GERMAN MEASLES

This is a mild exanthem, whose specific characteristic is shown by its not preventing the subsequent development of scarlet fever or measles, to both of which diseases its eruption has some resemblance. Rubella is characterized by a rash, which in one part of the body may resemble scarlet fever, and in another part may resemble measles. Its only distinctive characteristic is found in the swelling of the post-cervical glands, which may be as large as a walnut, but it never shows the severe angina of scarlet fever or the catarrhal symptoms of measles. Its incubation period is very irregular, ranging, according to some writers, from one day to four weeks. The rule is that the fever is very slight, and so also the constitutional symptoms. In epidemics it may become very contagious, and it almost always prevails in an epidemic form. It calls for no special treatment except segregation and rest in bed.

TYPHUS FEVER

I became too well acquainted with typhus fever when I was physician of the New York Quarantine, for the immigrants were chiefly Irish, and came over in slow-sailing vessels. I sometimes boarded these ships, and can never forget the foul odors between decks, where the immigrants were huddled together. These conditions were most efficacious in causing the worst epidemics of this disease. In the year previous to my accepting the position the health officer himself and five physicians of the hospital died from contracting typhus. It was then especially prevalent among physicians, so that two years afterward, when I was connected with Bellevue Hospital, five of its house staff succumbed to its infection.

Historically, it was one of the worst scourges among men, especially in the camps of armies, while now it is well-nigh extinct, particularly in the United States, due to the recognition of its extreme con-

tagiousness, which leads at present to the prompt isolation of the patients. It is not only the sick who are dangerous, but, like small-pox, one can give the infection to others from its lurking in the clothes. The case is mentioned of a whole court of judges and their attendants contracting it from prisoners brought before them from their jails. One of the names of this fever, therefore, used to be jail fever. It is a curious illustration of the prolonged confusion of this fever, with the totally different disease of typhoid fever, that the term "typhoid" means that it is like unto typhus, whereas no two diseases could be more distinct. After I came to New York City from the Quarantine I found myself in controversy, at a meeting of the New York County Medical Society, with a majority of the speakers, who claimed that typhoid fever was simply abdominal typhus. It would be well, on that account, to change the name of typhoid to that of enteric fever, as it is frequently called in England.

Symptoms.—A review of the most characteristic symptoms of these two fevers is arranged in parallel columns for illustration:

<i>Typhus.</i>	<i>Typhoid.</i>
Highly contagious.	Not contagious.
Onset rapid.	Onset gradual.
Subsides usually by crisis.	Subsides by lysis.
Eruption may be as early as the second day, and may be complete in forty-eight hours; no fresh eruption after the completion of the first appearance.	Eruption late, discrete; disappearing and reappearing in other places.
Eruption soon becomes hemorrhagic and then petechial.	Eruption neither hemorrhagic nor petechial.
No characteristic internal lesions.	Very characteristic lesions in the intestine.
Duration not much above two weeks.	Duration four weeks.
No relapses.	Relapses about one in five.
Causative agent unknown.	Causative agent Eberth's bacillus.

The onset of this fever is usually sudden and marked by a rapid development of muscular and general prostration, so that it is uncommon for a patient to continue up and about on the second day. Besides the headaches, there are the general aching in the back and limbs characteristic of most acute febrile infections, consisting of chills, headache, and frequently nausea, the fever rising to 103° or 105° F. The face is very flushed and the conjunctivæ congested. The tongue is dry and tremulous. Delirium, so common afterward, does not occur at the beginning, except in alcoholics. The pulse, in contrast to typhoid fever, is usually rapid at the beginning and not dicrotic. The abdomen does not show any particular features, except that the

spleen is early enlarged. About the third to the fifth day the eruption appears, first on the abdomen, then on the chest and shoulders, then over the back and extremities. The face becomes very much reddened and swollen, but rarely shows the characteristic eruption, and the palms of the hands and soles of the feet usually escape also. The rash usually requires from forty-eight to seventy-two hours for its full development. With the development of the eruption delirium sets in, and may rapidly become maniacal. The expression then is characteristic, the eyes being like those of one under high excitement. In this state the patients have to be watched, lest they injure themselves or others. During this period the eruption changes, a certain number of spots becoming petechial, and, with this, the eruption becomes much more prominent, and always a dirty bluish color. In the second week the active delirium subsides, and the patient lies in a stupor or coma vigil, with intense prostration, the eruption meanwhile changing in color, from the increase in subcutaneous hemorrhage, until it becomes a characteristic dusky hue, the temperature continuing high, from 104° to 105° F. or over, the pulse becoming progressively more feeble. Toward the latter part of the week, if the progress is favorable, the temperature drops rapidly. If the defervescence is prolonged, complications must be looked for. The cutaneous petechiæ outlast the defervescence and may remain as brownish spots. As recovery sets in, sweating develops. Recovery may be quite active, with returning appetite. On the other hand, death may occur in the first week, with severe toxic symptoms. It is rare for death to occur after the second week. The temperature, which has continued high, begins at the middle and close of the second week to drop, often rapidly. In certain fatal cases hyperpyrexia occurs before death, the temperature reaching 108° or 109° F. The pronounced nervous symptoms characteristic of the complaint are of purely toxic origin and not accompanied by organic changes. Early severe delirium is unfavorable. Muscular tremor is very common, without the characteristic tremor in typhoid of the tongue, often marked by subsultus; occasionally distressing muscular cramps develop. Epistaxis is uncommon, but there may be a catarrhal condition of the respiratory tract, with a dry cough and altered voice. The laryngitis may be accompanied by actual ulceration of the cartilages. The supervention of any form of pneumonia, in typhus, is serious. All the signs of myocardial weakness may develop, the first sound of the heart changes, and, in bad cases, is actually inaudible. The red corpuscles show no decline, but there is generally moderate leukocytosis. A high leukocytosis, like that of

30,000, is unfavorable, but it is said that the persistence of eosinophiles is a good omen. The tongue becomes dry and even fissured with the progress of the disease, while sordes accumulate about the teeth and lips. Gastric and intestinal disturbances are both of little account compared to what they are in typhoid. The kidneys are not affected more than is common in all severe febrile conditions.

As usual with all febrile infections, there may be different grades, some cases of typhus being very mild, but ambulatory typhus is unknown. Typhus fever in childhood is not very common, and the course of the disease is usually milder. More males than females are attacked, from difference in the exposure of men to the infection. The older the patient, the more serious the outlook. Fat persons, as in other febrile infections, are bad subjects. Rarely will typhus attack tuberculous patients, and, as a membrane is not uncommon in the throat in typhus, it is possible to be taken for diphtheria. Another distinction between typhus and typhoid is that neither of those diseases protect against the other, for patients with typhoid have been mistakenly sent into typhus wards and there have contracted that fever. Typhus fever invariably increases in gravity according to the limitation of air space. Alcoholism is also unfavorable, as well as advanced age, already referred to.

Prophylaxis is of special importance in the cases of physicians and nurses in hospitals. The high mortality of this class is largely due to overwork, predisposing to the fever.

Treatment.—As to treatment, we have no specific against this infection, and our object should be to sustain the patient until the relatively early advent of the crisis. If the patient is in a comatose condition, great care should be taken lest he choke while being fed. He should be often turned from side to side to lessen the danger of hypostatic congestion, and the mouth should be frequently cleansed by washes of chlorate of potash.

This serious fever is far less prevalent, both in America and in Europe, while in Ireland it used to prevail with great mortality.

Some physicians who have not seen a case of it have supposed that very different eruptive fevers are now mild forms of typhus. One such form has been described by Dr. N. E. Brill, Attending Physician of Mt. Sinai Hospital, New York, as occurring in his service there among Russian Jew emigrants, and which he invited me to see. I found the eruption wholly different from the typhus with which I was once so familiar, and the clinical accompaniments still more unlike the old true typhus. I can imagine that if scarlatina should now be-

come extinct, how many red rashes would then be affirmed to be undoubted examples of that disease.

Recently, however, the etiology of typhus has taken an entirely new aspect. The American investigators, Drs. Anderson and Goldberg, working in Mexico City, discovered that typhus is due to the bite of a louse, just as malaria and yellow fever are caused by the bites of mosquitoes. During this investigation an American physician named Ricketts fell a victim to typhus as Dr. Lazear martyred himself during the United States Army investigation into yellow fever in Cuba. Nicole, a Frenchman, had also studied typhus in Morocco, and he likewise maintained the louse transmission theory, which is now very well established, especially since Dr. Plotz, of Mt. Sinai Hospital, New York, has not only identified and isolated the germ of the disease, but has discovered an effective vaccine against it.

DIPHTHERIA

This formidable disease is of no recent origin, for it is plainly described in ancient writings, such as that of Aretæus in the year 111 A. D., and that of Galen in 180 A. D., who performed tracheotomy for a membranous exudate in the trachea. From the beginning, however, it has shown much variation in its prevalence, which may be extensive at one time, and then die out for long periods, in a given locality. Thus in Boston it prevailed to such an extent in the years 1735-36 that the city authorities had a conference with the medical profession as to limiting its ravages. In 1771 a severe epidemic in New York was carefully observed by Dr. Samuel Bard, who wrote a treatise on the subject, describing it, like the Boston physicians, as *putrid sore throat*. But when I came to the city of New York in 1861 many physicians doubted its existence, and uniformly spoke of membranous croup, the reason for this being that its now common accompaniments of ulceration, paralysis, and affections of the heart, causing sudden death, were almost unknown, or at least not ascribed to it.

It was really not until Klebs and Löffler identified it in 1884 with a minute bacillus, which now goes by their name, that it was properly recognized as a specific disease.

It cannot be too clearly emphasized that at first this disease is a purely local infection of some mucous membrane, because the bacillus itself rarely enters the blood. It spreads, however, over the membrane, where it secretes one of the most virulent of poisons, which, by absorption into the circulation, causes its different effects. We dwell upon this fact here because of its practical importance, indicating

that it ought to be washed away by local douching before its membranes are sufficiently developed to generate this special virus. This may be done by the throat douche which we have described, but which, unfortunately, cannot be so effectively used if the seat of the exudation is in the nares. Diphtheria throws off its toxins in the same way that the tetanus bacillus infects locally, and there generates its toxin, which then enters the blood. Unfortunately, these two are the only agents so far known whose toxins are set free in the circulation. They differ, therefore, in this respect from other infections like the bacilli of typhoid fever, which hold their toxins tightly within the cells, and are, therefore, called endotoxins, for against the toxins both of diphtheria and of tetanus we have a recourse to chemical antidotes generated in the body, called antitoxins. When used early in the case of diphtheria, antitoxin has materially diminished the mortality of the infection. An antitetanus toxin has also been discovered, but it must be used so early in the disease that its efficacy is not equal to that of the diphtheria antitoxin.

Though the primary development of its membrane, on the tonsil, for example, may not be more than $\frac{1}{2}$ inch square, yet that may be sufficient to cause death. The rule, however, is that the membrane rapidly extends from its first seat, and grows thicker as well as wider, due to the formation of an abundant fibrinous exudation from the blood. Mixed with this fibrinous material there is another deposit of a hyaline character. Soon, dipping deeply into the subjacent tissue, this exudation causes ulceration, and from this ulcerated surface great quantities of streptococci enter into the circulation. This secondary infection may in time mask that of the diphtheria agent itself, and against it the diphtheria antitoxin may be of no avail, because the antitoxin is specific against the diphtheria bacillus only. Another fact should also be noted, that when this ulceration is deep, as well as extensive, the diphtheria bacillus itself may gain entrance into the blood, and thus account for the presence of this bacillus in the blood, quite independent of the presence of its toxin—all of which is another proof that the sooner the antitoxin is used the better.

Antitoxin.—The discovery of the diphtheria antitoxin is one of the most important in modern medicine. It was led up to by prolonged investigations by Behring, Roux, Sidney Martin, Chaillou, and Yersin. This antitoxin is present in the serum of animals rendered immune to the disease by the injection of many repeated small doses of the toxin. The horse is now practically the only animal whose serum is used for this purpose after he has been receiving

subcutaneous injections of the toxin for three months. At the end of that time a little blood is drawn, and the serum tested to determine the degree of antitoxic power which it has acquired. A somewhat arbitrary standardization of the antitoxic power is then adopted, taking for the immunity unit the amount of antitoxin serum which will neutralize a hundred times the minimum lethal dose of toxin, but as this varies, the dose is estimated by units and not by definite quantities. The best place for injecting antitoxin is near the angle of the scapula. The serum should be injected slowly, and the swelling caused by it should be allowed to subside without rubbing. The dose should be regulated altogether by the conditions of each case. If there is marked congestion of the throat, even if there be no membrane, 4000 units should be given, and then at the end of four or six hours a second dose of the same size should be administered, and this should be repeated until the membrane has disappeared. If there be very extensive membrane when the patient is seen for the first time, 8000 or 10,000 units should be given, repeated every four or six hours until the membrane begins to shrivel, with the diminution of the nasal discharge or other signs of general improvement. If a patient when first seen has very extensive membrane and a profuse discharge from the nose, cold, clammy hands and feet, and a feeble pulse, 20,000 units of antitoxin may be at first administered, and then 10,000 more, and then again 10,000 more. Some apparently hopeless cases have been saved by the administration of 50,000 units, given in the same divided doses above mentioned.

The effect of the use of antitoxin in diminishing the death-rate from diphtheria is shown in the case of the city of Boston. For the twenty years from 1875 to 1904 the average ratio of mortality per 10,000 of the population was 14.46, but while antitoxin was used, from 1895 to 1904 inclusive, the ratio was 6.42—a diminution of more than one-half. Such a lessening of mortality was demonstrated in similar statistics following the use of antitoxin in Europe, America, and Australia, and, therefore, could not be attributed to any local influences. For a time opposition was based upon the unsatisfactory results in the administration of Koch's tuberculin, but there is no parallel between these two forms of serum therapy, and now the verdict of the profession is unanimous that we have no agent so effective against diphtheria as the early and proper administration of the diphtheria antitoxin. The failure of these serums at the beginning was entirely due to too small doses being employed, and as there is practically no serious injury following these injections, there can scarcely be any danger from large

doses. Following the hypodermic use of the antitoxin temporary cutaneous eruptions may take place. These cutaneous eruptions may appear either in the form of erythema or urticaria. While these may occasion temporary annoyance, they have no permanent serious effects. The liability to these eruptions differs according to the antitoxin used, and is least in those preparations which are of the greatest efficiency. It must be admitted, however, that death has followed after the use of this injection in patients who have been subject to true asthmatic seizures. We have no explanation of this proclivity to react so injuriously to this agent, but enough has been observed to allow of precaution in chronic asthmatics.

Diphtheria of the eye may be caused in a physician attending a case by a pellet being directly coughed from the patient into his eye. Diphtheria of the eye is thus described by Dr. John H. McCullom, in Osler's "Modern Medicine," page 414, vol. ii:

"Diphtheria of the eye, or diphtheric conjunctivitis, is not infrequent. It is sometimes caused by the secretions of the throat of the patient being coughed into the eyes of the attendant, particularly in tracheotomy cases. The more common cause is auto-inoculation from the nasal discharge. Diphtheria of the eye commences with a slight congestion, which rapidly increases, and is followed by the formation of a distinct membrane which has a grayish-white appearance, a little different from that of the membrane in the throat. The process goes on very rapidly, so that at the end of twenty-four or thirty-six hours the eye is so inflamed that it is impossible to separate the eyelids. There are two varieties of diphtheria of the eye—the superficial and the deep—either of which is very serious. In the former the eye is invariably lost, in the latter it is sometimes saved. There is a considerable amount of constitutional disturbance and usually severe pain. The rapidity with which the disease advances is very great, so that sometimes in forty-eight hours the eye is hopelessly destroyed. In the milder attacks, even when the eye is saved, the morbid process continues for six or seven days. If the attack comes on, which is not infrequent, during the course of measles, the probability of saving the eye is very slight. The general condition of the patient is also an important factor in the prognosis."

Virulence.—From all which precedes, it is evident that the specific virus of diphtheria is one of the most virulent of known poisons. This is due to its well-nigh universal proteolytic or tissue-dissolving property. Every important organ of the body can have its tissues locally destroyed by it. Such changes appear the same in character in the

liver or the kidneys, but the most marked changes occur in the muscular and nervous tissues, and may involve the walls of the heart and its nerve ganglia. Moreover, death is ascribed to a similar degeneration in the cardiac branches of the vagus or pneumogastric nerve, producing heart paralysis. This is one reason why a patient should be carefully watched during his seeming convalescence. So long as the pulse remains weak and irregular, it is not safe for the patient to make any sudden exertion; even sitting up in bed has been known to cause immediate death weeks after the primary infection. Similar disorganization occurs in the peripheral nerves, leading to the familiar diphtheric paralysis, which usually begins with paralysis of the soft palate and marked by the muffled voice of the patient. Deglutition may be so interfered with as to lead to a regurgitation into the nose during the act of swallowing, but this peripheral nerve paralysis may be very widespread, so that the patient is unable to walk, or in other cases the trunk muscles are involved, which, in a few instances, causes the muscles of respiration to become weak or actually paralyzed. Frequently in diphtheria the knee-jerk is early abolished.

A practically important question is, How soon after his illness should a patient be permitted to go about? It may be safely said that this he cannot do so long as he has a discharge from the nose, for that may remain highly infective long after his throat or other symptoms have subsided; similarly, any other discharge, such as from the ears, is dangerous. Fortunately, unlike the case of the typhoid bacillus, the urine is not infected after diphtheria.

In the *kidneys* mischiefs caused by the diphtheria toxin are quite varied. Sometimes it may take the form of a glomerular nephritis. At other times the epithelium lining of the tubules may be the most changed, but the commonest derangement is in the form of an interstitial nephritis, which is very destructive; though a permanent interstitial alteration is not as frequent a sequel as after scarlatinal nephritis. In some instances, however, the infection of the kidneys is the immediate cause of death. When the diphtheria bacillus itself enters the blood in the manner which we have described it may cause endocarditis, as already intimated. Other extensions of the diphtheria process, such as diphtheria of the stomach, do occur, but are uncommon.

Laryngeal diphtheria is characterized by a different development of the membrane, due to the change from the throat to the tissues of the larynx and trachea. The membrane, not having in this situation

the same depth of submucous tissue, is often much looser in its attachments, and hence is not infrequently found as a detached cast within the lumen of the tube, and may, indeed, be coughed up as such by the patient. On the other hand, its extension into the bronchi and smaller bronchioles may be one of the chief causes of death, due largely to suffocation, induced by the struggles of the patient for breath, as well as the coughing. Virulent particles are thus inhaled, and set up extensive bronchopneumonia, a common cause of the fatality in diphtheria. In such cases, when the difficulty of breathing becomes marked, the question of advisability of tracheotomy or of O'Dwyer's intubation becomes imperative. The general trend of opinion is now more in favor of the intubation method, on account of the many dangers which accompany the tracheotomy, along with the use of the double tracheotomy tube, which is apt to become clogged up by the membranes being coughed into it. A sudden attack of vomiting during convalescence is always an alarming symptom, as it is a sign of degeneration of the vagus nerve.

One of the worst local developments occurs in the conjunctiva, which can become variously infected, but chiefly by the fingers of the patient. The treatment of this complication cannot be too prompt, for the tissues of this delicate organ become so rapidly involved that a loss of one or both eyes follows, particularly if diphtheria occurs during an attack of measles, as it not uncommonly does. Since measles specifically affect the conjunctiva, the conjunctivitis caused by the diphtheric exudation there becomes so severe that it is doubtful if the eye can then be saved.

Dimness of vision occasionally occurs as the result of the diphtheria toxin, and may be due to the weakness of the ciliary muscle, or to implication of the retina itself, with contraction of the field of vision. Squint resulting from paralysis of one or more of the ocular muscles occasionally happens, as well as temporary ptosis. The pupil is unaffected, though it may remain dilated and sluggish.

The early **diagnosis** of diphtheria is of great importance, and we may say that it cannot be established by the character of the exudation, but only by a bacteriologic examination. A membranous exudate can extend from the tonsils to the pharynx and soft palate, including the uvula, closely resembling diphtheric exudation, and yet may be wholly caused by a streptococcus. Follicular tonsillitis is also very common, marked by an exudation in the deep follicles of the tonsils, and quite often accompanied by a general constitutional disturbance and prostration, and yet not be diphtheric. At the same

time, as we have remarked, a true and very dangerous though limited development of a diphtheric membrane may be found on the tonsils, of which only a bacteriologic examination can determine its character. Nasal diphtheria also may be accompanied with so little discharge as to be easily overlooked. A widespread paralysis of the peripheral nerves has often come to my notice, in which the patients could not remember that they had had a sore throat.

The diagnosis can never, therefore, be regarded as certain unless established by a bacteriologic examination. In laryngeal diphtheria a valuable diagnostic symptom is the rigidity of the sternocleidomastoid muscles.

Treatment.—We have already shown that the chief advance in the treatment of diphtheria has been by the employment of the diphtheria antitoxin. In other respects particular measures against local lesions may be adopted: first in importance is the prompt and thorough douching of the affected part, as already described, but in other respects the physician ought to know how to deal with certain complications. The results of the diphtheric membrane on the conjunctiva we have already cited. The treatment for this complication should consist of repeated injections under the eyelids of a boric acid solution in distilled water, while the edges of the eyelids should be smeared, from within outward, with the ointment of ammoniated mercury. The swelling of the eyelids requires that these procedures should be as gentle as possible, though the eye may be continuously douched with warm water which has been previously boiled, the patient lying on his side, so as to let the fluid run out readily from the outer angle of the eyelid. Due to the rapidity of the morbid process these measures should be continued as uninterruptedly as possible—douched from the douche-bag but slightly elevated from the head.

Treatment of Peripheral Paralysis.—In peripheral paralysis of the soft palate an application should be immediately made to the parts of red pepper mixed with honey, applied with a soft camel's-hair brush, as red pepper does not produce any local inflammation, but only local hyperemia, and, unlike the tongue, the palate and pharynx are insensitive to red pepper. This application may be very freely made twice a day. For peripheral paralysis of the extremities or trunk there is no measure so effective as wrapping the parts up in cloths wet with an infusion of red pepper, of the strength of 1 dram of red pepper to the pint of boiling water. The duration of the paralysis may by this measure be very materially cut short, and is much superior to elec-

tricity. All local antiseptic applications are of doubtful value, and may be injurious to the throat if they are at all irritating.

Previous to the introduction of antitoxin I relied exclusively on the use of bromin locally and as a medicine administered internally. My reason was, there is no such efficient germicide as bromin. The only preparation of bromin that can be used for such purpose is Lawrence Smith's solution of bromin with bromid of potassium. This solution can be put up diluted with water, a dram of it to the ounce of water, and then applied locally. In bad cases I have even applied the solution clear. Internally I give it in doses of $\frac{1}{2}$ to 1 dram in 1 oz. of sweetened water or milk. Bromin is not only a powerful germicide, but also in this solution can be applied without producing any irritation, when, moreover, it acts as the best deodorizer. I have no doubt that in many cases of incipient diphtheria this application was of great use, but of little avail when the membrane was very extensive.

In *diphtheric affections of the heart* I would strongly protest against the use of digitalis, for I have seen the most distressing effects follow its administration. This ought to be expected, since we know that digitalis has no power for increasing the force of the heart-beat in any cases of toxic weakening of the heart muscles. Thus it altogether fails for this purpose, both in the cardiac debility of pneumonia and of typhoid fever. Its routine administration is based upon a mistaken idea that digitalis stimulates the contractility of the heart. It is, therefore, of great use when the heart is dilated in valvular and not in febrile affections, because it produces a cramp-like contraction of the dilated ventricles. Meantime it contracts the arteries, and as in diphtheria the arteries are everywhere contracted, digitalis further embarrasses the weakened heart by the difficulty which it induces in the circulation, owing to the diminished lumen of the blood-vessels. Strychnin is of some (but limited) use in diphtheric weakening of the heart, but the most potent remedy is the hypodermic administration of $\frac{1}{2}$ gram or $7\frac{1}{2}$ gr. of camphor, dissolved in 20 min. of sterilized olive or almond oil.

When possible the patient should be isolated in a large airy room, stripped of all carpets and hangings, so that it may be more easily disinfected afterward. The diet should be exclusively milk and lime-water. In laryngeal cases ice-cream is of use also, and there is no disease in which alcohol can be so freely employed to counteract prostration.

Affections of the kidneys in diphtheria may be very serious, first causing hemorrhage and then suppression. This disorder has no resem-

blance to the nephritis caused by scarlatina, and its treatment should be by hypodermoclysis, which can be best done in either flank and should amount to fully 8 oz. of normal saline. Meantime this should be supplemented by rectal irrigation with Kemp's rectal irrigator, using at least 2 gallons of normal saline twice a day.

PERTUSSIS—WHOOING-COUGH

Pertussis is essentially a spasmodic nervous disease affecting the larynx and caused by an infection whose specific agent has not yet been identified. Statistics show that on account of its complications pertussis causes more deaths than do scarlet fever or diphtheria.

Although highly infectious, yet not everyone can contract it, however long he be exposed to it. Of my father's four children, not one was infected by it, though each slept in the same room or bed with those who had it, and in my boyhood I shared the same bed with one who had it severely for three months. In my own case I seem to be immune against almost everything, having only caught measles in early life. While as physician to the New York Quarantine I was exposed to every communicable disease, from the deadly typhus, which is now nearly extinct, to Asiatic cholera. Unfortunately, I could not transmit this immunity, for my seven children were prone to catch everything, three of them succumbing to their infections. Small wonder, therefore, that the important subject of immunity is one of the most recondite and baffling of medical problems.

The disease is more than twice as fatal in the negro race than in others. The incubation period of this infection varies from seven to ten days.

Symptoms.—In the majority of cases it begins as a simple cold in the head, with slight fever, running at the nose, watery eyes, and an incessant cough, at first without expectoration. But the cough lasts unaffected by the usual remedies, and after a week takes on a convulsive character, with no attempt to interrupt the expiratory cough with any act of inspiration, as in other prolonged coughs. Now follows a series of some twenty short coughs, during which the child becomes blue in the face, when at last a deep inspiration is taken, which on account of laryngeal spasm causes the "whoop" from which the disease takes its name. Like other spasmodic nervous diseases, an aura very commonly precedes the attack, so that the child, by this, knows that it is coming on, and runs to its nurse or even clutches at any support in its neighborhood. The attack often ends in vomiting,

and in cases of very frequent attacks the food may be so often rejected as seriously to affect the nutrition. Owing to the extensive venous congestion, subcutaneous hemorrhages occur, particularly about the forehead, with ecchymoses of the conjunctiva and epistaxis.

Enlargement of the bronchial glands is quite common, and may be one of the causes of the laryngeal spasm.

The chief dangers of whooping-cough are from general bronchitis, causing bronchopneumonia. This is just what we might expect from the sudden spasmodic narrowing of the glottis, for a local constriction happening anywhere in the course of a bronchus, or by external pressure, produces serious results, and even more so when the narrowing occurs at the very beginning of the respiratory tract.

Treatment.—By far the chief indication in the treatment of whooping-cough is to prevent and abolish the laryngeal spasms. I can speak strongly on this subject, because we have a specific remedy for this which will stop the whoop in a very few days, and that is belladonna, properly administered. All depends on the mode of its administration, and the sooner this is properly done, the better. Differing from opium, which children bear badly, the tolerance of children for belladonna is remarkable, as was conclusively shown by Fuller. My rule is to begin with 3 drops of the tincture, for the first dose, and increase by 1 drop for the subsequent doses, at intervals of three hours, until the dose is reached which produces general reddening of the skin, beyond which further increase is not necessary. The dose which causes this reddening may then be steadily continued every three hours until the whoop ceases or occurs only at long intervals, when the belladonna may be given at longer intervals, the original dosing being at once resumed if the attacks become more frequent. In the majority of cases the whoop ceases under this treatment within four days. It must not be supposed, however, that the disease ceases with the whoop, for I have had children who have not whooped at all for four weeks, then catch cold and have the whoop return as bad as ever, with the further disadvantage that this relapse is more difficult to cure than the original attack.

Occasionally a complication occurs in the course of the disease—accumulation of flatus in the bowels, with now and then diarrhea. This is best treated by 10 gr. of subcarbonate of bismuth with 1 gr. of betanaphthol every three hours.

After the whoop has been suppressed by the belladonna, it is still necessary to prevent the child from catching cold, as above noted. For this purpose I strongly recommend the same measure spoken of

in the treatment of bronchitis in children, namely, that the child should sleep in a bag of cotton flannel, the upper end tied securely about the neck. In an extensive family practice in former years I never found this treatment to fail, and, moreover, I have never lost a case of whooping-cough.

The most sensitive part of the body to surface chill is the skin of the forearms. Among the host of remedies recommended for whooping-cough, I have no faith in any of them, except perhaps heroin, which may be given in $\frac{1}{8}$ gr. tablets at night. In weakly children, who begin the disease with their condition already debilitated, a dessertspoonful of cod-liver oil should be administered three times a day, after eating.

Whooping-cough not uncommonly predisposes to tubercular infections, or it may be the beginning of a lifelong asthma, the treatment of which is described on page 315. One fact cannot be too strongly emphasized, and that is the danger of every case of whooping-cough infecting others susceptible to the disease. This infection undoubtedly may occur during the catarrhal stage of the disease, but there is no telling when the infection ceases to be communicable; therefore every case of whooping-cough should be jealously kept from other children for at least three months from the onset of the complaint.

MUMPS—EPIDEMIC PAROTITIS

This is a very common disease due to an infection whose specific agent has not been identified. That it is highly contagious is shown by its rapid spread among young recruits in barracks, in schools, and similar institutions, especially when crowded. It has no characteristic premonitory symptoms, but begins with moderate fever and usually a swelling of the parotid glands on one side. This swelling becomes rapidly very pronounced, causing a bulging not only of the cheek, but also of the lower structures about the external ear. After the third day the parotid on the other side becomes involved also, with a very characteristic tumefaction of the sides of the face and neck. In a majority of cases this condition, even when there is a good deal of swelling, is not accompanied by marked systemic symptoms, but occasionally there is high fever, a good deal of pain on swallowing, and even delirium. It is difficult also for the child to open its mouth and to swallow. The disease is by no means fatal, and lasts, as a rule, for a full week.

Mumps, however, is characterized by one singular complication, namely, orchitis. Although there is a great deal of swelling and pain about the infected organ, yet suppuration is not a feature of the disease. Unfortunately, however, cases do occur in which the orchitis is followed by atrophy of one or both glands. I have myself had an instance in a married man in which only traces of the testicles were to be found. He nevertheless had preserved sexual power, but, to the great disappointment to himself and his wife, he had had no children. In a few cases at the height of the disease otitis media occurs, which may be followed by more or less deafness.

Treatment.—In the majority of instances no treatment other than being confined to bed is necessary. When the swelling is great, much relief may be obtained by wrapping the neck and cheeks in cotton batting upon which laudanum has been sprinkled, and then covering with oiled silk.

When otitis is complained of, the laudanum may be dropped into the ear by the apparatus ordinarily used for filling fountain pens, and then a pledget of cotton may be left in place, care being taken not to push it in too deeply. Only liquid nourishment can be administered at this time.

For the orchitis, the testicles should be supported by the ordinary suspensory bandage used for such purposes in other conditions, and the patient confined to his bed until all symptoms have subsided.

INFLUENZA—LA GRIPPE

This remarkable infection has prevailed from ancient times, the most probable proof of which is from allusions to widespread epidemics which came and disappeared in former times, but without the clinical features of the other infectious diseases which we have been reviewing. The most salient feature about influenza is its sudden development as a special pandemic, but it was not until late years that its various accompaniments have been identified with the disease. As no other disease is characterized by such rapid onset in a community, it was natural that for a long time it should be regarded as depending on meteorologic conditions, but it is now pretty definitely settled that it follows the tracks of commerce so surely that we must regard it as always proceeding from person to person rather than from place to place.

Its **clinical features** and accompaniments differ remarkably according to its particular epidemic prevalence, many of its striking peculiarities occurring chiefly when it first invades a community. On that account I prefer to mention my own personal experience with the epidemic in New York in the year 1890. I was attacked, while riding in my carriage, with a sudden acute pain in my forehead. I drove home and at once went to bed for the first time in twenty years from illness. The pains rapidly developed in my limbs, with the ordinary characteristics of an acute febrile infection. The catarrhal symptoms were but moderate, though when these subsided I had a sense of general prostration which lasted for six weeks. In that epidemic muscular debility was everywhere complained of. My experience among some patients during the subsequent months of its prevalence was unlike that of any cases which I have seen since, and the first that I would refer to were infections of the nervous system. I knew of 10 cases of sudden development of insanity, including 2 suicides, and 2 cases of chronic insanity which followed some very characteristic symptoms of influenza. During the epidemic of that year I met a number of cases of intractable vomiting, 3 of whom were fatal, the vomited masses being greenish, and with a sour odor which filled the room. In each of these cases the patients died during an attack of syncope. In 1 case the patient recovered from vomiting, but soon afterward the skin desquamated from head to foot. Besides this, I saw some other curious cases in consultation, a principal symptom of which was profuse sweating. One was in a patient of the late Dr. Erskine Mason, in which the perspiration ran through the mattress and dropped upon the floor.

As a rule, the first signs are those of a catarrh of the respiratory

tract, beginning in the nose, and then traveling down with signs of bronchitis, and lastly, with development of scattered areas of bronchopneumonia. Throughout, the fever does not run high. The cough may be either slight or very severe, with viscid expectoration, in which yellowish globules are suspended, and which, on examining with a high-power microscope, may first reveal the true nature of the infection. This cough with its bronchitis may soon subside, but in some cases continues for two months or more. Occasionally the process extends to the pleura, producing the localized pleuritis or even empyema, the bacillus being found in pure culture in the purulent collections. Besides symptoms referred to the respiratory organs, we may have widely scattered disorders, chiefly of a nervous kind. Severe attacks of pain may be localized either in the head, in the sides of the chest, or in the abdomen. At other times one or both the sciatic nerves may be involved, but through them all there is the significant accompaniment of general muscular debility. For these pains, often markedly periodic, we have a specific in the form of fluidextract of ergot, to be given in dram doses, which may be repeated in three hours, but often the first dose is sufficient.

The **causative agent** of this disease was first demonstrated by Pfeiffer in 1892 and 1893, and consists of a minute bacillus which can be recovered in pure culture from the pellets above mentioned, suspended in the expectoration. A remarkable peculiarity of this organism is that it may be found stored up in localities either in the respiratory tract or in out-of-the-way places throughout the body. Thus, it has been found in the gall-bladder, in abscesses in the limbs, and also in the substance of boils. It has been demonstrated as thus continuing for one or two years after its systemic symptoms have all disappeared, quite similar in this respect to the long survival in some situations of the typhoid bacillus after the patient has wholly recovered from the primary infection. It is this peculiarity which has caused some writers to advance the explanation of the outbreak of influenza in scattered localities, both in Europe and America, so as to connect various epidemics in different years with one another.

Though the **mortality** from influenza itself is not very high, yet every epidemic is accompanied by a greatly increased death-rate in the locality, and notably by the subsequent development or progress of phthisis. This is just what we should expect from an infection causing chronic bronchopneumonia, and for similar reasons the pulmonary lesions show a very marked mixed infection with pneumococci, various streptococci, and the influenza bacillus in conjunction

with the tubercle bacillus. On the other hand, a very chronic cough with localized areas of induration may be caused by the influenza bacillus, so that from the clinical symptoms alone, which may include hemoptysis, it would be impossible to establish the diagnosis. But if there is a considerable amount of expectoration and of persistent absence in it of the tubercle bacilli, the presence of the influenza bacillus should be looked for.

Treatment.—Our remarks on treatment will be brief, because I think that I have found a true specific against this infection which consists of the following prescription: Phenacetin, 3 gr.; sulphate of quinin, 2 gr.; extract of aconite, $\frac{1}{12}$ gr.; Dover's powder, $\frac{1}{4}$ gr., made into 1 pill, 6 of these pills to be taken the first day. On the second and third days 1 pill before each meal, and 2 at night should be administered. In the majority of cases the disease subsides on the third day of this medication, but in cases of very chronic cough there may be continued 1 pill, four times a day, for several weeks. The most striking change in the symptoms, whether constitutional or local, is shown on the second day. These pills are now sold by the thousands in different parts of the country under the name of the compound phenacetin pill (Thomson), the formula in each case being given on the label. I am assured that this combination is quite as specific against the influenza bacillus as quinin in ague and mercury in syphilis. These pills are manufactured by Schieffelin & Co., 170 William St., New York.

CHRONIC DISEASES IMMEDIATELY COMMUNICABLE OR CONTAGIOUS

SYPHILIS

No disease merits the designation "contagious" more than syphilis. It is originally propagated only by actual contact. Notwithstanding its multiform and remarkably varied manifestations, it remains throughout them all the same specific affection, due, as now demonstrated, to an infection by a single organism. The unity of syphilis, therefore, can no longer be denied.

Like other general infections, its historic origin is obscure. Thus, it has been asserted that it was described by a Chinese writer 2637 years before Christ, but with no better grounds for belief than its supposed identification with the most diverse lesions mentioned in the writings of antiquity. It is incredible that syphilis, as known to us, should not have been observed by the Greek and Roman physicians, because they were both careful and clear in their descriptions of the symptoms of diseases, and, moreover, opportunities for propagating it then were

beyond those even of modern times, as impure sexual intercourse was sometimes actually sanctioned by their religion. Their literature, particularly that of their satirists, allowed their repeatedly alluding to the ravages of syphilis, if they were at all acquainted with them. Juvenal would have taken advantage of parading the hideous manifestations of syphilis on the countenance more than Shakespeare does. It is admitted by all authorities that this disease, as we now know it, dates from about the close of the fifteenth century. Its manifestations at that time were extraordinarily serious, as is commonly the case with entirely new epidemics. These severe developments gradually decreased until the disease has assumed its present character.

Syphilis has been classed by eminent writers among the exanthemata, like scarlet fever and small-pox, but syphilis radically differs from such acute affections by being the most chronic of diseases, often lasting for a lifetime in the development of its later, but always specific, lesions. Neither small-pox nor any other exanthem continues to manifest its presence by special symptoms not for one but for twenty years after the first infection. Some of the late sequelæ of these exanthemata are really due to subsequent infections by very different organisms.

That syphilis should be classed as an exanthem would be natural if the characters of its secondary stage were alone observed. After the first infection there follows a definite period of incubation, at the end of which, as in the exanthemata, a fever occurs, with a general eruption on the cutaneous and mucous surfaces. But, unlike exanthemata, the symptoms of the second stage are followed by a series of characteristic disorders which may develop in every tissue of the body. These may continue indefinitely through long years. Also, unlike exanthemata, it can be propagated to the unborn offspring of syphilitic parents, and that it is the same disease is proved by the presence of its own special organism in the infected offspring. It is true that small-pox may be so propagated through the blood of the mother, but like small-pox elsewhere it quickly passes through special phases and ceases, but congenital syphilis continues as a permanent infection, so that it is truly inherited syphilis and not an inherited exanthem.

The contagiousness of syphilis is strikingly illustrated by its transmission from one person to another by mere contact with its secretions; thus, the secretions of the mouth of a syphilitic infant may convey the disease to a healthy wet nurse. Physicians are also repeatedly infected through some abrasion on their fingers while at-

tending syphilitic women in confinement. Hence, it is incorrect to class this infection with other diseases whose clinical course is totally different, simply because, at one period, it resembles an exanthem.

The truth is, as we shall see, that syphilis resembles nearly everything in its manifestations without being the actual thing. For example, it is one means of diagnosing a syphilitic eruption, that though it may closely simulate other cutaneous affections, it always remains different from them in some important particulars. Unlike the exanthemata, which usually are simply infections of the blood, syphilis ultimately involves every texture and tissue of the body. Usually beginning in a moral delinquency, it then becomes the most universal physical curse which is known, and not the least serious is its hereditary transmission to which we have alluded, though by proper treatment its first stages may be cured in the children who have survived. Yet years afterward it shows its continuous operation in them by the notched appearance of the permanent teeth (incisors).

Etiology.—Though long suspected to be due to an infection by a specific organism, which was erroneously identified with different agents by various investigators, it was not until 1905 that it was demonstrated by Schaudinn to be owing to a spirilla presenting distinct characters, and which he named *Spirochæta pallida*. This is a long, delicate, non-refractile, spirally curved organism, whose average length is from 4 to 14 mm. Some of them, however, are only from 2 to 3 mm. in length, while others 20 mm. long have been observed. It is pointed at both ends, with sharp, clear-cut, corkscrew-like spirals; the large number of spirals in proportion to the length of the organism being a characteristic feature. Extremely delicate flagellæ are present, usually one at each end. It is, therefore, a motile organism, moving actively in the blood and through the tissues. It has no spores. One of its most marked characteristics is that it stains with difficulty. It does not stain by Gram's method. It is found in the greatest numbers in sections of organs from children dead of congenital syphilis, in which cases the tissues may literally swarm with the organism. Among the spirilla it most resembles the *Spirochæta refringens*, but the latter is larger, thicker, and quite easily stained, while its spirals are broad and wavy rather than corkscrew shaped.

That it is the specific cause of syphilis is proved by its constant appearance in primary and secondary syphilitic lesions, appearing unmixed with other organisms in the depth of such lesions and in the blood. It is in the most contagious syphilitic lesions (chancre, condyloma, and mucous patch) that this organism is most often found.

It is also found in the internal organs in the specific eruptions, and in the blood of congenital syphilitic children, but particularly is its presence in the placenta and in the umbilical cord striking, because of the absence of other organisms in these situations. In non-leptic lesions this organism is always absent. It also disappears under the treatment which cures syphilis.

Clinical Course.—The most common primary manifestation of syphilis is the Hunterian chancre, so-called from its description by John Hunter. This chancre appears, as a rule, within the first three weeks after infection. It begins with an itching in the affected part, but usually is quite painless and free from sensitiveness on pressure. Ordinarily, when first noticed, it appears as a small pimple, and then forms a brownish-red, firm nodule, with a shallow surface depression, circular or oval, and quite hard. Its edges are sharply defined, terminating abruptly, and in this respect it differs from ordinary inflammations. The surface of the base is regular, bright red, and on a level with the surrounding tissues, while the center is often grayish. The secretion from it is scanty and thin, and suppuration does not commonly occur. This sore is ordinarily single, though occasionally multiple. The chancre is not accompanied by general constitutional disturbance, and though the neighboring lymph-channels, particularly along the dorsum of the penis, are involved, they are not red. Inguinal buboes, however, soon develop in both groins, but they remain discrete, hard, free from tenderness, and do not suppurate. In men the most common seat of this chancre is on the frenum or in the coronal sulcus; in women, it may occur anywhere on the external genitalia. These are its most ordinary situations, but from special causes infecting chancres may be found in various parts of the body. With the appearance of the eruption, retrogressive changes in the chancre itself usually begin. The induration diminishes, the central portions of the chancre undergo fatty degeneration, and finally the sore disappears, though a scar may persist and last for a long time.

Secondary Stage.—After a lapse of about four to eight weeks from the appearance of the chancre, the disease changes rather suddenly from a local to a general one, with a great variety of constitutional signs and symptoms. The constitutional symptoms are that the patients feel badly, with a loss of weight and strength. Headache comes on with the characteristic of being much worse at night. The tonsils are swollen, and the throat becomes sore. If this angina spreads to the uvula and soft palate, the appearance is almost pathognomonic. The inflamed area is dark crimson, but abruptly separated

from the healthy mucosa by a sharp border. Anemia then begins, sometimes with palpitation and a sense of oppression in the chest. General enlargement of the lymphatic glands occurs, but the glands are not large, and they are painless, hard, discrete, and do not suppurate. The most frequent of these glands to be involved are the post-cervical, the sternomastoid, the submaxillary, the epitrochlear, and the axillary.

Fever is a frequent phenomenon of this secondary stage, and has much the character of rheumatic fever, accompanied by headache, nausea, and pain in the limbs. The type of the fever is usually remittent.

The secondary syphilitic eruptions may be diagnosed by the following common features: First, they are usually circular or nearly so; their development is slow, and successive groups of eruptions are dissimilar and more or less symmetric in their distribution, with a reddish copper color. They cause no itching, and are rarely painful. They tend to disappear, but often leave behind them stains or scars. They also tend to become generalized and to involve large areas of skin, being particularly present on the forehead and the extremities. The dorsal surface of the hands, wrist, and feet are exempt. The scales are thinner, more superficial, and less abundant than those seen in non-specific lesions. When crusts are formed they are greenish brown or black, with rough surfaces, and more easily detached than in non-syphilitic lesions. Finally, they are of different shapes.

The second stage is often inaugurated by the appearance of a measly, roseolous rash. It takes place about the forty-fifth day after the appearance of the chancre, seen first on the flanks and sides of the thorax, and thence extending to the trunk and to the extensor surfaces of the limbs. Pressure makes them disappear only in the early stages. Unlike the exanthemata, its rash comes out slowly, and then persists for several weeks before it finally disappears. Recurrences are not infrequent, and may be repeated for several years.

Next follow the papular eruptions, consisting of round, reddish, raised pimples, which may be of the diameter of a ten-cent piece. They are most often situated on the trunk and face. It may take a form like lichen. Later, this papular eruption, which comes on three or four months after the onset of the disease, is often capped by a small pustule or covered with crusts which are arranged in groups, having a general resemblance to psoriasis. There may be also a large papular eruption, particularly about the natural orifices of the body, but they may be seen on the neck, trunk, chin, and palms. This eruption

usually starts on the forehead, and then spreads to the abdomen and the rest of the body, and may greatly disfigure the patients by the patches running together. This syphiloderm appears in the palms of the hands and the soles of the feet. Fissures and ulcerations are not uncommon in it. It is chronic in its course, and obstinate to treatment. A moist papule passes into the broad condyloma, especially near the anus; it appears like a flat button-like excrescence, elevated above the surrounding skin and bathed in a foul, thin secretion. Condylomata are much commoner in women than in men, and are very contagious.

The large pustular syphiloderm begins as a large lenticular papule, which rapidly becomes pustular. The pustule soon ruptures and dries up into a crust. The lesion usually lasts for a long while, the crusts heaping up to form the rupia syphilitica. The base increases in size, and the lesion in height, becoming finally cone shaped. The diagnosis between the large pustular syphiloderm and variola is sometimes difficult. The syphiloderm, however, makes its appearance more slowly, and begins upon the trunk and not upon the face. The tuberculous syphilid links the preceding eruption with that of the gumma, which does not usually appear until about two years after the initial sore. When it disappears, it leaves behind it a marked scar.

Changes in the Hair and Nails.—Alopecia is a frequent sign of secondary syphilis, appearing during the third or fourth month of the disease, often circumscribed. One feature which is good for diagnosis is that there are no broken hairs in the spots. The eyebrows may be affected at the same time, and occasionally fall out entirely. The prognosis, however, is good, as the hair grows in again. Changes also occur in the nails, which may be cracked or hypertrophied.

Lesions of the Mucous Membranes.—These are quite constant and important manifestations due to the contagiousness of their secretions. The most characteristic lesion is the well-known mucous patch, seen oftenest in the mouth as a reddish papular area, topped by a small erosion, occurring at various places in the buccal cavity and quite often on the tonsils. Mucous patches often repeatedly recur during the course. Their occurrence on the tonsils and soft palate is a point in diagnosis. The eruption may involve the larynx, changing the voice or even causing aphonia.

Tertiary Syphilis.—Between the second and the tertiary stages there is no sharply marked limit, the rule being that tertiary developments occur about three or four years after the chancre. In many cases tertiary changes occur in those who have not had treatment.

In general, the lesions of the tertiary stage are marked by lack of orderly appearance, by their persistence, by their non-symmetric arrangement, by their relative non-infectiousness, by their tendency to ulceration, and by their little tendency to hereditary transmission. Tertiary lesions may occur in the trachea or bronchi, and may occasionally lead to serious disorders in breathing.

One of the most characteristic of the tertiary lesions is the gumma. It may begin like a papule, but destructive changes are present which give the lesion its character. First there is softening of the connective tissue, which is converted into a mucoid mass. At first there are no new blood-vessels formed, but later these become a feature. The gumma may be surrounded by dense sclerotic scar-tissue, closely resembling tubercle, particularly in its tendency to caseous change. Gummata may be found anywhere. But in the liver they produce great destruction of tissue, followed by extensive fibroid changes, by which this organ may seem to be tied in parts as if with a rope. These liver gummata may even be mistaken for cancerous tumors.

Syphilis may occasion nephritis; this may occur early in the secondary stage, but is very favorably affected by antisyphilitic treatment.

Syphilitic Changes in the Arteries.—This is the most common cause of death which can be traced to syphilis, particularly in its relation to the origin of aneurysms. It may show itself in endarteritis of a gummatus kind, especially in the arteries of the brain. Sometimes in the smaller arteries it takes the form of obliterative endarteritis. The most common change, however, occurs in the large arteries, especially the aorta, and has no connection with ordinary atheroma. The parts of the aorta most frequently involved are the root and the lower part of the thoracic or abdominal aorta. These changes at the root are very apt to involve the aortic valves, and equally so the origins of the coronary arteries of the heart. The recent development of an aortic murmur in a comparatively young subject without any antecedent history of rheumatism is very suspicious of the presence of syphilis.

Syphilitic Affections of the Heart.—These may occur in the form of endocarditis, but more commonly in the affections of the walls of the heart; in other words, of the myocardium, in which small gummata are found, which become surrounded by fibrous tissue. These fibroid changes are not uncommonly the cause of sudden death.

We may say, in general, that only careful, personal examination of superficial syphilitic manifestations, such as eruptions, ulcera-

tions, etc., will enable one properly to diagnose the majority of syphilitic manifestations of the heart. Descriptions in books cannot convey to the mind of the student the mental pictures upon which he can rely, compared with his own careful, personal observation.

Colles' Law.—This law, named after Dr. Abraham Colles, a surgeon of Dublin, refers to the curious fact that a syphilitic mother may give birth to a child which may not show any signs of syphilis. Should the mother nurse her child, she will show no effects from so doing, but should a healthy woman act as wet-nurse to this child, she will become infected by nursing it. This shows that the syphilitic mother is immune to the infection, but not one who has not been syphilized.

Cerebral Syphilis.—Besides the late parasyphilitic affections, such as tabes and general paralysis of the insane, cerebral syphilis may occur quite independently of these affections, and relatively much earlier in the history of the patients. As to symptoms, the first is headache, which is very intense, with a tendency to increase toward evening and in the early morning, while during the day the patient is relatively free from it. I have relied upon one remedial measure on account of its furnishing the clew to the diagnosis, and that is to administer $\frac{1}{6}$ gr. of calomel every fifteen minutes until six doses are taken. This often greatly relieves the headache, which it would not do in headache from any other cause. This headache may be general or more or less limited to one side of the skull, upon which it is often found that there is a tender spot on cranial percussion. This headache may continue for some time, until the onset of much graver symptoms, such as hemiplegia, aphasia, or epileptiform attacks. Commonly associated with the headache is insomnia.

The symptoms may arise first from vascular lesions, causing hemiplegia and aphasia. Others may be due to the development of gummata in the cortex and in the subcortical tissues. These are characterized by epilepsy, frequently focal, with attacks of more or less permanent aphasia, or there may be symptoms due to meningitis, situated either in the dura or in the pia arachnoid, producing monoplegias or palsy of one or more cranial nerves. Occasionally the mental symptoms are very grave, due to diffuse lesions of the blood-vessels, the patients passing into a state of dementia, the latter being caused by actual occlusion of the cerebral arteries, which, if complete, are not recovered from; but if incomplete, they come and go with signs of transient hemiplegia or aphasia or mental confusion, lasting only a few minutes or many hours, but passing off. All forms of aphasia may occur from vascular occlusion, not only of the motor type, but

also of the sensory forms, with word-deafness or word-blindness. These symptoms point to disease of the middle cerebral artery or its branches, which is the vessel most commonly affected by syphilitic arteritis. Next in frequency comes the basilar artery and its branches.

Symptoms Produced by Gummata.—These are very similar to those of the brain tumors, and may, therefore, be either partial or distinctly focal. Thus, an epileptiform attack may involve the leg or arm or the face, or the whole of one side of the body. It is, therefore, difficult to separate symptoms due to gummata and to localized syphilitic meningitis, because both conditions are apt to occur simultaneously. Syphilitic pachymeningitis of the base is a common cause of paralyzes of the cranial nerves, the nerves most affected being the optic, the third, and the sixth.

Treatment.—All writers agree that the treatment of constitutional syphilis cannot begin too soon, some even claiming that if mercurial treatment is begun when the presence of an infecting hard chancre is suspected the infection already present in the blood and just beginning to show signs of a syphilitic exanthem may be arrested in its course then and there. For this purpose Mr. Jonathan Hutchinson's line of treatment might be adopted, of 1 gr. of hydrargyrum cum creta, given in pill, in combination with $\frac{1}{2}$ gr. of opium, so as to prevent diarrhea. The two complications during this treatment to be avoided are salivation and diarrhea. The salivation may be best prevented by cleansing the mouth and the use of alum mouth-wash. This pill should be given four, five, six, or seven times a day, without regard to meal-time. All soups, green vegetables, fruit, beers, and wines should be strictly forbidden. As a rule, Dover's powder appears to be more effective in preventing diarrhea than its equivalent of opium. This treatment should be carried out for twelve months without any intermission.

After twelve months the doses may be decreased in number, but still continued for another year to prevent relapses. I have myself pursued a similar treatment by giving $\frac{1}{20}$ gr. of calomel four times a day, increasing the dose by $\frac{1}{20}$ gr. every day until the bowels become loose, whereupon the dose should be decreased until the patient is no longer so affected. That dose which does not produce any symptoms is then taken as the standard dose for that patient, and should be continued for two years. If the patient should first come under observation some time after infection, his particular dose of mercury, shown by the same procedures as above mentioned, should be found out and then followed as before detailed. Another method of mercurial

treatment is by mercurial inunction. In this treatment 1 dram of the ordinary blue ointment should be rubbed into the skin every night, beginning with the surface on one side of the thorax, and on the succeeding night by a like application on the other side. After that the application can be made on the surface of the inner aspect of each thigh alternately, and then return to the original place on the thorax, the reasons for these intermittent applications being that a too continuous use of this ointment at one place is likely to cause severe irritation of the skin. When a rapid effect of the drug is desirable, as in iritis or in situations where the syphilitic lesion is dangerous, the mercurial vapor-bath may be used, according to the directions given in text-books.

In syphilitic diseases of the nervous system, I invariably use intramuscular injections of the corrosive sublimate, as I have found these injections to succeed much better than any other modes of administering mercury for these particular infections. The injections consist of $\frac{1}{4}$ to $\frac{2}{3}$ gr. of corrosive sublimate dissolved in 20 min. of distilled water. The needle of the hypodermic syringe should be passed directly into the substance of the gluteus muscle, for there it causes but little pain, which it would do if it were injected into the tissues just under the skin. These injections should be repeated once or twice a week. In the London Lock Hospital similar injections are used for all forms of syphilitic infections, chiefly on account of their greater convenience to the patients. Corrosive sublimate is much less liable than other forms of mercury to produce either salivation or diarrhea.

For tertiary lesions, or for those involving the periosteum in the later stages of secondary disease, the iodid of potassium has long held a deservedly prominent place. The preparations of iodine cannot be described as truly curative of syphilis, but they are remarkably effective in relieving syphilitic exudations in the fibrous tissues, whether in the later secondary or in the tertiary stages. The dose of the potassium iodid is to be gaged solely by its remedial effects, some late tertiary lesions requiring very large doses, such as 140 to 240 gr. per day. In early syphilitic periostitis with severe pains 10 to 20 gr. three times a day may be given along with doses of opium and fluid-extract of conium. The doses, however, should be regulated by the patient's ability to bear iodine in its various forms, and they should be diminished as soon as the patient shows signs of iodism. This is made plain by a catarrhal affection of the mucous membrane of the nose and throat as well; sometimes, by a disturbance of the stomach, patients becoming feverish along with symptoms of general debility.

With some patients signs of iodism are caused by small doses, in which case the idiosyncrasy of the patient seriously militates against his relief. Preparations of iodine and mercury are very often combined, not in the same prescription, but rather taken together, constituting what is called mixed treatment. Thus, I have found pills of the biniodide of mercury, from $\frac{1}{25}$ to $\frac{1}{20}$ gr., of service in cerebral syphilis, combined with counterirritation at the nape of the neck by application of the biniodide of mercury ointment at night until the spot becomes sore.

One of the greatest discoveries of modern times we owe to the genius of Paul Ehrlich. Recognizing that syphilis is due solely to the multiplication in the body of Schaudinn's protozoön, the *Spirochæta pallida*, Ehrlich made extended researches for the discovery of a specific poison for this organism, finally settling upon a substance which he termed "Number 606," to represent his last experiment. This agent ("606") should be termed dioxydiamido-arsenobenzol to represent its true chemical composition. As this name was altogether too long to be readily pronounced, it is now generally termed salvarsan. It is administered by injection, preferably into a vein, because when introduced either into deep muscular tissue or subcutaneously it causes great pain, and sometimes actual sloughing. Nothing could exceed the prompt efficacy of this injection, the most serious ulcerations, whether of secondary or of tertiary lesions, healing with marvelous rapidity. It was natural, therefore, that it should at first be hailed as the long-sought-for specific against syphilis, and doing away with every other treatment, including that of mercury; but ere long it was found that relapses sooner or later occurred which, with some, served to discredit its use, and the claim was made that we had no trustworthy agent against syphilis except mercury. The true causes for these relapses, however, are not properly understood. We have no knowledge of the life-history of the *Spirochæta pallida*, and there can be no doubt that it may pass through hitherto undiscovered larval forms, which may survive the poisoning by salvarsan of the adult forms of the organism. We have a number of illustrations of this in other infectious organisms, and while we may doubt that salvarsan may wholly supplant mercury in the treatment of syphilis, yet it may be of essential service by repeated administrations in finally ridding the system of this organism.

Further experience has demonstrated the advisability of combining the administration of salvarsan with a true mercurial treatment, which ensures recovery much more certainly than either salvarsan or mercury alone.

Salvarsan, however, has certain serious drawbacks. Its administration was apparently more effective when given deep into muscular tissues, as in the substance of the gluteus maximus muscle, than when given intravenously; but when injected into the muscular tissue it was apt to produce very severe pain accompanied by inflammation and even abscess at the site of the injection. It was a great gain, therefore, when Ehrlich announced the discovery of the preparation which he called neosalvarsan, and which now has quite superseded the original salvarsan in practice. Ehrlich claims that neosalvarsan is superior to the original salvarsan in the following particulars: (1) High solubility; (2) neutral reaction; (3) low toxicity; (4) therapeutically as effective, if not more so, than salvarsan itself; (5) it does not cause reaction symptoms, such as diarrhea and vomiting, even after large doses. The bulk of neosalvarsan is greater than that of salvarsan, 0.9 gm. of neosalvarsan corresponding to 0.6 gm. of salvarsan. In administration of neosalvarsan for intramuscular injections 0.1 gm. of neosalvarsan is dissolved in 180 c.c. of water, which has been distilled on the same day, then sterilized and cooled to room temperature. As previously remarked, all preparations of salvarsan are immediately destructive of the life of any kind of spirochete, and hence are constantly used against trypanosomiasis in all its forms.

The average single dose of neosalvarsan for men is 0.75 to 0.9 gm.; for women, 0.6 to 0.75 gm. This may be repeated according to its effect, and in some cases it may require to be repeated at intervals of a week for three months to prevent relapses.

TABES DORSALIS—PARASYPHILITIC AFFECTIONS

As a rule, these are the latest manifestations of syphilitic taint, occurring most strikingly in chronic nervous affections, such as tabes and paresis, or general paralysis of the insane. Tabes, commonly called locomotor ataxia, is the most noted of these affections. At first it was vehemently denied by eminent neurologists that syphilis had anything to do with the genesis of tabes, but of recent years the opinion is gaining ground that cases of true tabes without syphilitic infection are rare. Erb says that syphilis is the antecedent of 90 per cent. All agree, however, that other factors, such as exposure to cold or fatigue, or similar debilitating agencies, predispose to develop the disease in those who have the luetic taint. The same may be said of the dementia paralytica or the general paralysis of the insane. The peculiarity of these parasyphilitic affections is that they hardly, if at all, are amenable to the usual antisiphilitic remedies.

The hard infecting chancre of Hunter is by no means the only venereal sore. There is also what has been very properly called a soft chancre, termed by some "cancroid." This sore occurs nearly as often as a true chancre, but fundamentally differs from the latter in that it does not infect the general system. As its name soft chancre implies, it is not indurated and its edges are not sharply defined. It may, however, produce the most extensive, and sometimes dangerously sloughing ulcers, characterized by an abundant discharge of pus. It also involves the inguinal glands, more commonly on one side, which enlarge and form abscesses called suppurating buboes, but does not infect the general system. Unfortunately, no one can be sure from the characters of the initial sore that it is not an infecting chancre, because constitutional infection has occurred in many cases of apparently soft chancres, so that it is probable that an infecting chancre will grow on a soft chancre. The suppurating buboes leave permanent scars in the groins, whose presence may be of service in showing that the patient has not a general syphilitic infection.

The treatment of this soft chancre by no means corresponds to the treatment of true syphilis, for it is fundamentally different from a syphilitic infection of any form. It should be treated by appropriate caustics, which will change it into an ordinary cutaneous sore. The directions for this belong more properly to books on surgery.

Clinical Symptoms.—Of the clinical symptoms of tabes the earliest are its characteristic pains. They are sometimes called "lightning pains" and usually begin in the lower extremities. These pains are paroxysmal, beginning suddenly and darting down the affected limb. As previously described in the chapter on Pain the gestures of the patient are characteristic, using the index-finger to indicate how they shoot down the limb. Another feature never present in inflammatory pain is that the patient forcibly grasps the limb as if thus to arrest it. Occasionally, instead of being shooting in character, it is located in a part of the bone usually just above the ankle, and is then of a boring character, as if the part had an auger passing through the bone. These pains may first affect the limb of one leg and then the other, or the arm and leg of one side or of both sides. The patients often complain that life is rendered miserable by their existence. I have known tabetic pains to set in as early as the third month after the infection, but usually they are much later in their manifestations. On examining the skin with an esthesiometer or with a simple pin-prick, irregular areas of total anesthesia may be found which have no parallel in any other disease.

This is the place for alluding to a very striking character of tabes, namely, the loss of knee-jerk. Normally, if one leg is crossed over the other, on striking the tendon of the quadriceps as it crosses the patella, the leg with the foot is thrown forward, particularly if at the same time with the stroke both fists are clenched. In certain spinal cord affections this kick of the leg is much exaggerated, but in tabes it is wholly absent. Other affections, however, are characterized by loss of the knee-jerk, particularly in diabetes mellitus, and very often the same absence of knee-jerk occurs at advanced age. The value, however, of the absence of the patella reflex in tabes is that this symptom is then not alone, but accompanied by equally characteristic changes in the pupil of the eye. In some cases of tabes both pupils are symmetrically contracted; more commonly, however, one is contracted and the other is not, or even dilated, but whatever their condition be the pupils are wholly insensible to light. It is then the presence of the symptom called Argyll-Robertson sign is so valuable, for though the pupils are insensible to light they will dilate or contract according to accommodation. In health when an object is brought near the eye, the pupil dilates as the object is approximated and contracts as the object recedes, but in tabes this change in accommodation is preserved, though otherwise the pupil is insensible to light.

Besides the characteristic pains of this disease, other equally important symptoms develop in the action of the muscles. This consists not in weakness or paralysis, but in a special derangement of muscular co-ordination, from which it gets the name locomotor ataxia. This incoördination strikingly resembles the irregular movements of a drunkard, and is due to the same paralysis or absence of what we call the muscular sense when there is no paralysis of the muscles. By this muscular sense the brain is informed of the state of the muscles, and knows how to coördinate the necessary movements in the performance of every muscular act. When the muscular sense is absent, both in the drunkard and the tabetic, the patient does not know the whereabouts of his legs or even of his arms, and thus both staggers in his gait and finds himself incapable of performing the simplest act, such as buttoning clothes or tying his shoe-strings. The difference, however, between the tabetic and the drunkard is easily demonstrated—the tabetic is obliged especially to use his eyes. If he is standing and closes his eyes he sways from side to side or actually falls to the ground. He, therefore, never can lift his eyes from his feet while walking, nor is he able to walk in the dark. His gait is almost decisive of the presence of his disease, for he brings his heels down heavily first, so as to

communicate the jar to the spine, and it is not until this is done that the rest of the foot will follow; but the ataxia is equally present in the arms. Tell him to bring the tips of the fingers of both hands together and he cannot do so if his eyes are closed, the fingers passing one another in attempting the act. Also, when asked to touch the tip of his nose with his index-finger when his eyes are closed, he may touch instead his cheek or his ear. One of the earliest signs of this ataxia is present in his handwriting. He cannot keep on the same line, and the down-strokes are much more pronounced than the up-strokes. Ask him to put a pin through a sheet of paper, and he does so with unnecessary force even though his eyes are open. As the disease progresses the muscular incoördination increases, so that the patient is no longer able to walk and has to remain in bed, while he is so uncertain as to the position of his limbs that he has to be watched to prevent them from being thrown out from under the bedclothes. Meantime, it should be borne in mind that the muscles are not paralyzed any more than those of a drunkard. It is only that they cannot be made to work together.

Disturbances of sensation are apt to accompany the muscular incoördination, and here also these usually begin in the lower limbs. The patient has sensations of tingling, pins and needles, or numbness, and when walking he may feel as if he were treading on cotton-wool. About the trunk also he may have a girdle pain like the sensation of a cord tied tightly about the body. Examination may then show that there are various degrees of loss of sensation on the surface, such as inability to feel the prick of a pin, or if he does, that the sensation of pain is delayed in its transmission to the brain. Along with this the sensation of posture may be lost, so that he cannot tell how his legs are placed without looking at them. Likewise, he may be unable to discriminate the difference of weights placed in his hands. The ataxia usually slowly gets worse, spreading upward to hands and arms. Meanwhile the most obvious disturbance of sensation is in the darting, so-called "lightning pains" already referred to. These shoot usually from above downward and are often very severe. Sometimes the lightning pains disappear as the disease advances, but the signs of the pupil and the absence of the knee-jerk remains. Disturbances of the action of the bladder in micturition may occur early in the disease, and take the form first of inability to start the stream, and then of irregular checking of the flow. Often after the patient has thought that he had finished micturition, an immediate desire to pass water may set in, in which his efforts may or may not be successful. Sometimes these

attacks are called "vesical crises." As the disease progresses, paralysis of the bladder may become complete. The sexual impotency, which may have been preceded by undue sexual excitement, becomes complete. The patient may finally be confined to his bed, being unable to walk, and is then likely to have bed-sores and inflammation of the bladder. Other characteristic changes also occur. Muscular weakness may be general or local. Paralysis of the ocular muscles may develop from affection of the third nerve or one or more of its branches. One superior oblique may be paralyzed, either partially or totally, and yet after a while recover again, though not always. Occasionally, these ocular palsies may be bilateral, as for example, double ptosis. These transient palsies are usually syphilitic, but it should be remembered that they may be difficult to discriminate from disseminated sclerosis, a disease with which syphilis has nothing to do. Occasionally, tabetics show some of the symptoms of hemiplegia along with epileptiform fits, or attacks of vertigo with coma. Their transient character, however, shows them to be of tabetic origin. Local paralysis may also occur in other nerves, such as the radial, ulnar, and peroneal nerves. Paralysis of one-half of the tongue may be due either to the paralysis of the hypoglossal nerve or of its nucleus. Occasionally, the muscles may be so weakened in their tone that they allow stretching beyond anything normal.

Relation to the Special Senses in Tabes.—Complete deafness may be caused by tabes, but affections of the ear are not so common as those of the eye, in which the optic nerve atrophies. This is sometimes an early sign, and is estimated by some as 15 per cent. of the cases of tabes. I had 1 patient referred to me who was completely blind from this optic atrophy, but who could walk without any ataxia. The patient first notes his failure of vision in one eye, and then after that in the other, the trouble progressing until it ends in complete blindness. Occasionally, a progressive paralysis of the external ocular muscles occurs until it becomes complete. Like the optic atrophy, this is an early sign. It may begin with ptosis, first of one eyelid, then of both. This is frequently accompanied by external squint caused by paralysis of the sixth nerve.

Visceral Crises.—The commonest of these in tabes is the gastric crisis, pain beginning in the epigastrium, then nausea, and soon vomiting of a most severe and intractable character, and nothing will stay on the stomach, though the tongue is clean and the temperature normal. After lasting for two or several days, accompanied by great prostration, the vomiting suddenly ceases, leaving the patient very

weak. These gastric crises are usually early in their appearance, and pass off as the disease progresses. Sometimes the crises are intestinal, shown by attacks of diarrhea, or the patient has attacks of tenesmus, with pains in the rectum. There are also laryngeal crises, due to a bilateral affection involving the abductor muscles only, when the cords may approach gradually nearer to the middle line until the glottis is reduced to a mere chink. Such a patient is evidently in constant danger, and a tracheotomy may be required at any moment, yet occasionally some patients are but little discommoded, though the glottis is considerably narrowed.

Circulatory System.—Frequency of the pulse nearly always is present in tabes. Attacks resembling angina pectoris may occur, and have been called cardiac crises.

Trophic Lesions.—Probably the most serious of the accompaniments of tabes are the peculiar affections of the joints and bones. Thus, a knee-joint may be wholly disorganized by a sudden attack of what is called Charcot's disease. The joint first swells to a great degree, but without any inflammatory appearance or pain. Not long afterward it is found that the bony surfaces making up the joint are wholly disorganized, the ends of both the femur and tibia literally going to pieces, with fragments of bone scattered through the exudation, with a remarkable feature that the joint disease is wholly unaccompanied with pain, the patient first noticing the trouble from his inability to walk. Along with this the bones become very fragile, so that the mere act of turning in bed may be enough to break the thigh bone. This affection of the joints and bones may come on early before the symptoms of ataxia. The fractured ends usually set about to repair, much as in other fractures, except that the amount of callus may be disproportionately great, so as to resemble a tumor. Other irregularities may then set in. In certain places great atrophy of the bony structures occurs, while with others hypertrophy follows instead, producing extensive osteophytes. Occasionally, the ease with which the bones may be broken is extraordinary, as in a case mentioned by Foquet, in which, on trying to extract a tooth, the whole alveolar process came away. These bony derangements in tabetics may be multiple, for in 1 case there were seven fractures. In about 75 per cent. of the cases in tabes the joints affected belong to the lower extremities. It is curious how often all premonitory symptoms are absent. These affections of the joints and bones are closely imitated by the results of syringomyelia, but in this latter affection the joints of the upper extremity are much more likely to be involved than the lower. An-

other serious result of this complaint is a perforating ulcer of the foot, which may also come on early. It begins as a corn, seated usually on the ball of the great or of the little toe. Under this suppuration occurs, and ulceration which may extend into the joints. Occasionally the results are not so serious, and the ulcer spontaneously gets well.

Morbid Anatomy.—In tabes the commonest, most obvious anatomic change is the degeneration of the posterior spinal roots and the posterior columns of the cord. On opening the spinal canal it will be observed that the pia-arachnoid is thickened over the posterior surface of the cord, while the posterior roots are thin, flattened, and atrophied. The posterior columns are considerably shrunk, and are grayish in color, contrasting strongly with the white anterolateral columns. Likewise, the posterior roots entering into the formation of the cauda equina are atrophied to a greater degree than elsewhere. Normally, the posterior roots are two or three times as large as the anterior, but in advanced cases of tabes they waste to such a degree as to be even smaller. Besides this, various cranial nerves may be atrophied. The gray atrophy of the optic nerve is obvious to the naked eye, but many peripheral nerves also show degeneration. Microscopic examination of the spinal cord shows the myelin-sheath of the nerves destroyed. The axis-cylinder process may be very irregular, swollen in one place, or completely atrophied in another. The neuroglia is increased at the expense of the parenchyma. The walls of the blood-vessels are often thickened in the sclerosed area and not elsewhere. Sometimes the vessels are so much thickened as to become almost obliterated. The pia-arachnoid membrane is also thickened, as if from chronic inflammation.

The spinal degeneration in tabes corresponds to the intraspinal distribution of the nerve-roots. These roots on entering the cord divide into ascending and descending fibers. Degeneration of the fibers connecting the posterior roots with the anterior cornua would account for the loss of the reflex tone in the muscles and for the loss of the knee-jerk. Other fibers from the posterior roots run for a short distance upward and then turn into the gray matter. Around the cells are Clarke's columns. They also degenerate in tabes, and, as Clarke's columns are the origin of the ascending cerebellar tracts, this degeneration cuts off one route to the cerebellum, which may give rise to disturbances of equilibrium. Research shows that the posterior ganglion is by no means so much implicated as the posterior root. Many hypotheses have been advanced to account for the involvement

of the posterior roots in tabes, but none of them explain all the facts. Thus, degeneration of the peripheral nerves supplying the skin, bones, joints, etc., and, above all, optic atrophy, cannot be explained on any of these hypotheses. In addition, there may be a localized paralysis and a progressive ophthalmoplegia due to degeneration of the ocular motor nuclei. All these considerations show that the morbid process in tabes is of a general nature, and not a local lesion of the posterior nerve-roots. It may be said, therefore, that syphilis produces a toxin which may act on the nervous system in general, but which has a primary particular action on the posterior root neurons.

Treatment.—We have already stated that parasymphilitic affections, whether tabes or paresis, seem not to be amenable to antisymphilitic remedies. Recently, however, the treatment of these parasymphilitic disorders by salvarsan and neosalvarsan has been stated to be more or less efficacious. Time only will show whether this be true or not, but in these otherwise hopeless affections it may be well to try salvarsan administered intravenously.

As to tabes itself we are obliged to attend first of all to the alleviation of the lightning pains. For this purpose there can be no doubt that we have valuable agents in the coal-tar series, such as antipyrin and phenacetin. Phenacetin is the least depressing of them all, and there is no case on record of any fatality following upon its administration, however large the dose. It may be well to combine each dose with from 1 to 2 gr. of caffein citrate with $\frac{1}{40}$ gr. of strychnin. I have thought that application of the actual cautery in a special form has done good. This is best done by heating the tip of an ordinary glass tube to redness in the flame of an alcohol lamp and then quickly applying it to spots along the spinal column, when, if done properly, the external epidermis snaps on application. The tip of the tube should never be allowed to remain long enough to make a sore, and the application may be begun at the neck at intervals of 1 inch apart for 10 inches. After this procedure a continuous red line joins all the spots touched. The next application should be after an interval of three days, and thus continued until the whole spinal column has been traversed. I once had a patient cauterized in this manner 4800 times, the operations being done by his wife, this counterirritation constantly relieving his tabetic pains.

In addition to the treatment of tabetic pains which we have already mentioned, something may be done to improve the nutrition of the spinal cord. The only medicines which have any testimony in their favor are arsenic, preferably in the form of the cacodylate of soda, of

which $\frac{1}{4}$ gr. may be given three times a day. Care should be taken, however, not to produce even the earliest symptoms of overdosing with arsenic. Those symptoms would be a sense of weight at the epigastrium after eating, and then puffiness of the eyelids, sometimes with numbness and tingling in the fingers.

In former times nitrate of silver enjoyed some repute in the treatment of degenerative diseases of the spine. I think that it still deserves to be reckoned as a restorative agent in such diseases. Thus, I had a case of a patient who suffered from an organic difficulty in his sacrum due to the pressure of a small tumor involving the anterior root of the first sacral nerve. The consequent pain had the peculiarity of coming on in the late afternoon and continuing through the night. In him this pain was markedly relieved by the administration of a pill containing $\frac{1}{4}$ gr. of silver nitrate. He had no idea what he was taking, but so soon as the pill had to be intermitted, lest its too long continuance would cause discoloration of the skin, he at once knew that something which afforded him great relief was no longer being administered, and he recognized the return to the remedy after an intermission of four weeks.

A very promising method of treatment of ataxia in walking is that devised by Dr. Fränkel, of Heiden, Germany, of which Dr. Starr thus speaks: "This method depends upon the fact that the act of walking, while ordinarily automatic, may be voluntarily directed. In locomotor ataxia the automatic mechanism is disturbed, but an effort of the attention combined with a progressive training of the muscles may enable one to acquire a voluntary gait, which assists or takes the place of the automatic gait. The Fränkel movements consist of attempts to follow a straight line, or a curved line, or a triangle upon the floor with the tip of the toe; then, when these motions can be accurately performed by the aid of sight, further motions, such as taking a step of a definite length, going up stairs, and going through various bodily exercises, are learned. These exercises should be gone through with several times a day, the patient resting for five minutes after every five minutes of exercise. While patients can acquire these motions themselves after instruction, yet it is found that they improve much more rapidly if they are personally instructed by the physician every day. As a result of such continued instruction the gait may be materially improved. I have known patients who had been unable to walk for several years to regain the power. For details of this method the reader is referred to Fränkel and Goldschneider's books on

the treatment of ataxia. Well-fitted boots with side supports to the ankle and rubber heels may assist the patient to walk."

This measure is certainly based upon physiologic principles. There seems to be no limit to the power of training muscular coördination, whether it be in the performance of the most complicated movements of the fingers in playing on a musical instrument or in the execution of coördinated acts in mechanics. We might say that everything comes by training of the muscles, or, in other words, by incessant purposive actions of the muscles made to work together by the will until they seem to be automatic. Just so a child learns how to walk. To do this, as every one can note in a child when learning to walk, the same persistent drill of the muscles must be gone through, which calls for the highest development of muscular coördination, for the human child is no quadruped, but has to learn how to maintain his equilibrium on two small feet, and at best he has to spend months ere he acquires this power. The system of Fränkel, therefore, is simply going back to the original lessons of childhood, emphasizing, however, the fact that it can be successful only by constant repetition.

PARESIS, OR GENERAL PARALYSIS OF THE INSANE

It is a noteworthy fact that ordinary forms of insanity, such as melancholia and mania, are not accompanied by any recognizable lesions of the brain itself, persons dying of these affections showing on a postmortem examination what would seem to be perfectly healthy brains. One great example, however, of true structural changes in the brain is found in that syphilitic disease called paresis, or general paralysis of the insane.

Paresis is justly called tabes of the brain, and not uncommonly it supervenes upon a chronic tabes of the spinal cord. On the other hand, it may apparently develop independently of the spinal disease. Like tabes, it may first show itself years after the primary infection, and sometimes its symptoms may manifest themselves either very gradually or suddenly. Its prodromata are often manifested in changes about the eyes and face. In the eyes there may be irregularity in the pupils. Occasionally they may be symmetrically contracted, but more commonly one pupil is larger than the other. Muscular twitchings are common in the area supplied by the seventh or facial nerve, and in speaking there may be an explosive utterance due to irregular movements of the lips. The mental symptoms, however, very soon dominate everything else. A change in the disposition of the patient is first noticeable, and this often takes the form of what is called meglomania with delusions

of grandeur, the patients who may be paupers regarding themselves as multimillionaires, and speaking of their great financial projects. At other times they break into fits of uncontrollable temper with their relatives, and in such states may commit crimes of violence. Often during the course of the mental disease the patients are subject to epileptiform fits, frequently ending in temporary comatose condition. Apparent remissions may mark the course of the malady, which, however, is really progressive, involving not only the mind, but developing signs of irregular paralyses of the motor functions, from which the patients finally take to bed. These paralytic symptoms are very irregular at first, but gradually increase, so that ultimately both mental and bodily functions are generally abolished. The patients usually die from intercurrent affections, such as pneumonia or other visceral derangements.

The textural changes found in the brain at autopsy consist of a general meningitis involving both the dura and the leptomeninges. The brain thus becomes adherent to its coverings, if not to the internal tables of the skull. One very constant feature is the exudation of blood on and in the superficial layers of the cortex, so that it is called by some a hemorrhagic meningitis. Like tabes, this disease is a great deal more prevalent among men than among women. Many causes to which it has been attributed, such as worry, injuries, and sexual excess, can rank only as predisposing and not as true causes of the complaint, as it is doubtful if any similar disease characterized by such lesions ever occurs without syphilitic antecedents.

This serious complaint is admittedly incurable, and we should only attempt to deal with intercurrent symptoms.

GONORRHEA

It is doubtful whether, when all its complications and sequelæ are considered, gonorrhea may not rank equally with syphilis in the mischief which it occasions. It is one of the greatest mistakes to consider it as a mere local disease, for though it does begin with a local specific inflammation, its causative agent, the gonococcus, can spread widely by infecting the blood and producing serious septicemia, which may be quickly fatal either by production of malignant endocarditis or by infecting the circulation. Osler mentions the case of a young man, "who within ten days of the primary lesions was seized with severe chill and high fever, from which he fell into a condition of profound toxemia, and died early on the morning of the fourth day from his first chill. At the autopsy there was found only a localized acute

urethritis and a small prostatic abscess, the blood being fluid, tarry-black, and unlike anything I have ever seen before or since."

Clinical Course.—In the great majority of instances, however, gonorrhea is simply a localized specific urethritis, but it is a serious mistake to confound it with a urethritis from any other cause. However local it may be at first, it is particularly obstinate to cure from the tendency of the gonococcus to burrow down into the mucous crypts of the urethra, so that all local measures, especially injections, pass over the infection. Gradually the gonococcus proceeds by continuity until it reaches the prostatic portion of the urethra, from whence it is very difficult to dislodge it. Acute inflammation of the whole organ may then follow, accompanied by painful erections, to which condition the name "chordee" is given. From infection of the prostate it may proceed by direct continuity to infect the testicle.

When the acute inflammation subsides, it often leaves a chronic non-purulent secretion called gleet, in which, however, vast numbers of gonococci remain present, and many cases of infection of women caused by a chronic gleet in their husbands occur with the same virulence as in the male, spreading to the uterus and then to the Fallopian tubes, causing gonorrheal salpingitis, and ultimately ovaritis. Thus, the results of gonorrheal infection may often be the cause of permanent sterility.

One of the most certain results, however, of a chronic gleet in the male is the production of more or less annular strictures of the urethra. We have already drawn attention to the fact that the outlet of no tube in the body may be safely obstructed. A localized pressure, for example, on a single bronchus, narrowing its lumen, is always a serious matter, and, likewise, a man with a localized stricture of the urethra cannot be regarded healthy because of the widespread mischief that may occur in any part of the urinary tract. Urethral strictures, therefore, are common causes of cystitis, and then of troubles in the ureters and pelves of the kidneys.

It is quite common for these strictures to be multiple, and they all have the peculiarity of recurring to their original state after attempts at dilatation have been made by the surgeon, who begins with a small bougie which would just pass through the stricture, and then uses larger sizes until one equal to the normal caliber of the urethra can be passed. Nevertheless, this dilating process is very unsatisfactory, for the strictures soon resume their original state of contraction. Even when the operation of internal urethrotomy has been performed, it is difficult to prevent relapses. Another feature of urethral strictures is that they

may become what is called "irritable." A patient may have been able to pass water in a fairly good-sized stream until he indulges in fermented liquors, particularly champagnes, and finds that shortly afterward he is hardly able to pass water at all. Similarly, an irritable stricture of the urethra becomes aggravated by wetting the feet in cold water. Patients generally learn to pass catheters or bougies for themselves, but the risk of infecting the urinary passages by this means is very great, while the introduction of the catheters or bougies is nearly always painful, leading in one case in my practice to attempt urination with such force that his bladder burst and quickly caused his death.

Urethral strictures may occur in serial succession for years after a single impure sexual connection. Like the same question which arises in syphilis, it may be doubted whether a gonorrheal infection is often really cured, for the gonococcus will remain hidden for years after it has lodged in the genital passages, to appear most unexpectedly upon some ordinary excitement.

Gonorrheal Rheumatism.—A not infrequent sequel of gonorrhea is a specific arthritis unfortunately called "gonorrheal rheumatism." As this is dependent solely upon the gonococcus, it has no relation to rheumatic arthritis, and it is not at all relieved by the salicylates. It is usually polyarthritic, in which the inflamed joints swell and are very tender. The fever, however, is comparatively slight. This arthritis also differs in attacking joints which are but rarely affected by rheumatism, such as the temporomaxillary and sacro-iliac. The effects of gonorrheal arthritis are very variable in different patients. One of the most serious of them is ankylosis. Thus a case is reported in which every joint of the body was permanently fixed, and the patient had to have some teeth extracted so that he could be fed through the opening. Some patients, however, experience only chronic pains about the joints, which are very obstinate, though they may not be accompanied by any signs of swelling. In other cases there is much effusion, both in the cavity of the joint itself and in the surrounding tissues, and pure cultures of the gonococcus have been demonstrated in these fluids. Frequently the joints attacked are: first the knee and subsequently the ankle. Gonorrheal arthritis is usually more obstinate than rheumatic arthritis, and relapses are very common. The local treatment of the joints is the most effective, consisting of the application of the actual cautery by the sudden touch of the tip of a glass tube heated to redness in the flame of an alcohol lamp. If a large joint, such as the knee, does not respond to this measure the surgeon

should open the joint and irrigate it. In relapsing forms of arthritis a careful examination of the discharge of the urethra may show that the source of the joint trouble is in some local development of the gonococcus, particularly in the prostatic portion. An antigonococcus serum has been tried, with very good results in the hands of some, while in the hands of others it has failed.

Treatment.—In the case of the strictures marked benefit is occasionally noticed after prolonged administration of iodid of potassium, 60 gr. a day, in divided doses three times a day. Should symptoms of iodism occur, the medicine may be suspended for a time and then resumed. In the treatment of the acute stage of gonorrheal urethritis with chordee I have found injections of tincture of aconite in doses of from 10 to 15 drops in 1 oz. of water, taken per rectum, the most serviceable. The rectum absorbs the water very quickly, so that in ten minutes it is as completely absorbed as if taken by the mouth, while its local action is much better gained in this fashion.

When a patient comes into the office having but recently contracted gonorrhea he should never be encouraged with assurance that his case can be readily or speedily cured. Every practitioner has his way of treating recent gonorrhea with injections of various agents. I believe that this indiscriminate use of fluid injections often tends rather to transmit the disease further down the urethra, and I think that, for reasons already stated, whatever the nature of these injections, they are of little efficacy, and I prefer to use only such mild injections as 1 gr. of sulphate of zinc to the ounce of water.

Should the urine be highly acid, it becomes much less irritating by making it neutral or even alkaline by citrate of potash in 20-gr. doses four times a day. The fluidextract of buchu also is very serviceable in reducing the irritation, and a frequent prescription of mine is fluidextract of buchu, 12 drams; liquor kali, 6 drams; syrup of orange and syrup of ginger, each 1 oz.; aqua menthæ, to make a mixture of 8 oz. Dose, tablespoonful in water an hour after meals and at night.

GLANDERS

Glanders is a rare disease due to a specific infection by the absorption into the blood of its active agent, named *Bacillus mallei*, first discovered by Löffler and Schutz. It belongs to infections from horses and is generally fatal in its course of ten days, if not earlier. Osler states, "There are signs of general febrile disturbance. At the site of infection there are swelling, redness, and lymphangitis. Within two or three days there is involvement of the mucous membrane of the

nose, the nodules break down rapidly to ulcers, and there is a mucopurulent discharge. An eruption of papules, which rapidly become pustules, breaks out over the face and about the joints. It has been mistaken for variola. In a Montreal case this copious eruption led the attending physician to suspect smallpox, and the patient was isolated. There is great swelling of the nose. The ulceration may go on to necrosis, in which case the discharge is very offensive. The lymph-glands of the neck are usually much enlarged. Subacute pneumonia is very apt to occur. This form runs its course in about eight or ten days, and is invariably fatal."

Treatment.—Osler states, "If seen early, the wound should be either cut out or thoroughly destroyed by caustics and an antiseptic dressing applied. The farcy buds should be early opened."

CHAPTER III

INFECTIONS COMMUNICABLE BY INTERMEDIATE CARRIERS

LOBAR PNEUMONIA

It is highly illustrative of the progress of our knowledge in recent years that lobar pneumonia is now not regarded as a primary infection of the lung. Instead of being a lung disease it is now considered a local manifestation of a general infection of the blood by the pneumococcus, which infection may cause death without any local manifestation in the pulmonary tissue or elsewhere. Rosenow has shown that previous to any development in the lung the pneumococcus may be found already circulating in the blood, and Hektoen, Flexner, and other competent authorities have found that the explanation of some cases of death occurring after a short period of high fever are due altogether to the pneumococcus, occurring in vast numbers in the blood without a single local development anywhere in the body.

The pneumococcus, in fact, is one of the most paradoxical as well as deadly causes of disease—paradoxical because it is found in the mouth and saliva of the majority of healthy persons. How it can act as a harmless saprophyte in the mouth and then become the commonest cause of death, at least in certain locations in the United States, such as in Chicago, where its victims largely outnumber the deaths caused by tuberculosis, is yet an unsolved problem. Likewise, it is difficult to explain its occurrence in widely separated organs of the body, where the clinical course of the disorders which it occasions are each different from one another, and their identity would have been unsuspected but for the demonstration of the presence of this micro-organism. Thus, it may occasion pleurisy without affecting the subjacent lung, and similarly peritonitis without inflammation of the contiguous viscera, or meningitis, due solely to its presence—also of both single and multiple arthritis, besides being a very common cause of otitis media in children.

In an article which I wrote some time ago, entitled "The Vagaries of the Pneumococcus," I described a purely localized development of the pneumococcus occurring in myself, causing an extensive inflammation

of the throat with desquamation of the tongue. These two attacks happened at just a year's interval between them, and their causation would have remained unknown but for my finding an article by an eminent throat specialist of England, Sir Felix Simon, who published 2 cases of this affection, the like of which in his great experience he had never seen before, and which proved to be by the pneumococcus from an examination of swabs from the throat. I, accordingly, had my throat secretion examined, with a report each time of pure culture of the pneumococcus. In Simon's cases and in my own the illness lasted for more than four weeks and was characterized by great muscular debility. With my first attack an unlooked-for sequel came on five weeks after the beginning of the infection, in the shape of a sudden but transient paralysis of the legs, from which I soon recovered in every respect, but a permanent weakness in walking followed. This paralysis in my case was similar to the paralysis following diphtheric exudations of the throat. In neither of Sir Felix Simon's cases nor in myself was there a single pulmonary symptom throughout the whole course of the affection.

The pneumococcus was identified as the cause of lobar pneumonia in 1886 by Fränkel. Previous to that various other organisms associated with pneumonic processes have been described, especially one form described by Friedländer in 1883, which consisted of an oval capsulated coccus which he had isolated and cultivated from cases of lobar pneumonia.

The pneumococcus is both aërobic and anaërobic, according to circumstances. In appearance it is a diplococcus. It occurs in the body-fluids in pairs, of which the individual members are lanceolate or candle-flame shaped, with the rounded bases in apposition. Cultivated on some media it assumes the formation of a streptococcus.

Clinical Course.—As might be expected in a general infection of the blood preceding local involvement of the lung, many cases show well-marked prodromata, such as headache, wandering pains or disturbances in the alimentary canal, as well as the respiratory tract. The nasal pharyngeal or bronchial catarrh not infrequently precede the definite onset of lobar pneumonia. In 80 per cent., however, the onset is sudden, when the course of the disease is presaged by severe rigor pain in the side, rapidly rising temperature, and characteristic pneumonic breathing. These cases usually present a definite crisis, and are relatively of short duration, the pulse being full and strong. On the other hand, the symptoms may be of a gradual onset, generally indicating a prolonged course with a termination by lysis instead of by crisis, and are more

likely to be attended by unfavorable complications. At this early stage some patients show a serious apprehension of the outcome of the disease, a symptom of unfavorable import.

During the onset the dyspnea is altogether out of proportion to the amount of lung involvement, and, if early accompanied by cyanosis, has an unfavorable significance from its indicating serious infection of the blood. This leads us at this juncture to refer to the great difference in that important element which is termed "virulence," for this element varies greatly in different epidemics, and a cyanosis which cannot be ascribed to the extent of the pulmonary lesion indicates a process of severe general poisoning. The rigors on that account vary, being sometimes short and at other times prolonged. Although the patient feels very cold during the rigor, the thermometer is already at a very high grade, and does not rise upon the subsequent development of the fever. One symptom is of great importance, and that is *burning heat of the skin*, sensible when the hand is laid upon the body. In no other disease is this symptom so marked, except in developing erysipelas.

An old saying in medicine is that pneumonia affert plus periculi quam dolores (more of peril than of pain), a statement which is quite true of those pneumonias which complicate other diseases, such as typhoid fever and Bright's disease, when the presence of pneumonia may not even be suspected until it is revealed at autopsy, but in typical lobar pneumonia, with a rigor and rapidly rising temperature, *pain* is one of the leading symptoms. It is then due to concomitant pleurisy, which further aggravates the dyspnea by limiting the movements of the chest.

Cough.—Every form of acute pleurisy causes persistent cough until the surfaces of the inflamed pleura are separated by an effusion of serum. At the onset of pneumonia the pleurisy is dry, the pain may be very severe, and of a stabbing character. As at this stage the secretion of the bronchi is scanty and viscid, the cough is short, hacking, and husky in its sound. Other symptoms often accompany the onset, one of which is *vomiting*, very often a first sign in children. It may be well to remark that the sudden onset of vomiting with fever in children is frequently due either to the development of scarlet fever or of pneumonia; in children also the first symptom may be a convulsion. It is not infrequent for severe pain in the region of the appendix to occur with the onset of pneumonia, especially of the right lung, and a number of instances have been reported where these patients have been subjected to the operation for appendicitis without revealing

anything wrong there. Therefore, in every case of pain so localized, a careful examination of the lungs should be made.

We may mention of the *respiratory symptoms* the play of the nostrils, and often a nostril of the affected side is more dilated than its fellow. The discoloration of the face consists of a bright flush, particularly pronounced on the malar processes, and not uncommonly more on the affected side. The breathing of lobar pneumonia may be of much diagnostic significance when compared to the pulse. The expiratory grunt is a sign of great diagnostic importance, especially in children. It may occur, although pain may be absent. A special change in the ratio of the pulse to the breathing is one of the most practical clinical signs of pneumonia, the normal ratio of the respiration to the pulse being 1:4.5, but in pneumonia it may be 1:3, 1:2, or even 1:1. As elements in the prognosis, the frequency both of the pulse and respiration is important. In adults a pulse that does not rise above 120 is not of much significance, but the prognosis becomes worse with every rise of 5 beats above that, likewise the respirations. At the beginning, when there is much pleuritic pain, the breathing may be quite hurried on account of the pain alone, but afterward, when the ratio characteristic of pneumonia between the pulse and the breathing has been established, the more frequent the breathing, the worse the outlook. A steady decline in the force of the pulse must be expected after the second day, but if a crisis has occurred and the pulse remains very weak this sign is unfavorable.

The onset of *delirium* in pneumonia is very common, but of varying significance. It is of great import if it occurs in alcoholics with the characteristics of delirium tremens. In others it usually bears some relation to the temperature, and in all cases calls for extreme watchfulness of the patients, because they may become suddenly maniacal, and endeavor to get out of bed, to throw themselves out of the window, or to attack their attendants. In senile and asthenic cases the delirium is generally of a moderate variety.

Insomnia is very common, and may be ascribed chiefly to rapid breathing attendant upon the disease. It should never be treated with full doses of opiates, because opiates work badly in all forms of pneumonia. Delirium is said to be more common when the apices are involved.

It has long been recognized that the *expectoration* of lobar pneumonia is characteristic, and has been described as rusty. This kind of expectoration may set in very early on the first day, but usually not until the second or third day. Its color is due to the admixture of

blood, and is viscid at the beginning and becomes more abundant toward the close by a mixture of purulent bronchial secretion. Occasionally, especially in apex pneumonia, the expectoration may be so bloody as to suggest the hemoptysis accompanying phthisis.

A notable feature of croupous pneumonia is its termination by crisis, in which the fever rapidly declines to normal or to below normal. Theories to account for crises are numerous. The causes of this phenomena, therefore, must be regarded as very obscure, the most probable of them being that great quantities of antitoxin are formed which arrest the pneumonic process. As a rule, the earlier the crisis the better. It may occur any day between the fifth and the tenth. The fall in the temperature may be between 5° and 8° in twenty-four hours; at other times it takes more commonly from thirty-six to forty-eight hours to become complete. Other phenomena often attend it, such as profuse sweating or the occurrence of diarrhea. In persons who are very much reduced, a crisis is followed by a more or less prolonged condition of general prostration and delirium which may have preceded the crisis. This may continue in a low form for some days afterward, accompanied in some cases by marked bradycardia.

The **anatomic changes** accompanying pneumonia may be divided into four stages: First, that of simple hyperemia; this is soon followed by engorgement, usually called the stage of red hepatization, and is caused by an extreme fibrinous exudation into the air-vesicles and the minute bronchi. The lung tissue in this stage becomes solid and heavy, and pieces of it sink in water. There is no frothy exudation apparent on the cut surfaces. When a lung is extensively consolidated, it becomes so swollen that the marks of the ribs appear upon it and the affected lung greatly increases in weight. A fourth stage is called gray hepatization, due to changes in the exudate, which now becomes largely infiltrated by leukocytes. It is remarkable how extensive these changes may become without affecting the structure of the air-vesicles themselves, for the whole exudation may be reabsorbed into the circulation, leaving the air-vesicles intact, and thus differing markedly from the changes in bronchopneumonia, in which, as will be subsequently described, both the walls of the vesicles and the interstitial tissues may become disorganized.

Auscultation.—Though it is not proposed in this work to treat fully the subject of auscultation, yet in pneumonia some remarks are advisable. The first change in pneumonia is an increase in the loudness of the breathing resembling that which is normal in children, and is, therefore, called *peurile respiration*. This is quickly succeeded by

absence of vesicular breathing and its substitution by an adventitious sound called the pneumonic crackle, which occurs only in inspiration, and cannot be coughed away as a similar sound can occurring in acute bronchitis. Another sign at this stage is that the expiration is clear and raised in pitch. Succeeding this is bronchial breathing, which is tubular in character, usually most pronounced in inspiration, but in extensive consolidation may be present in both acts of the breathing. In bronchial breathing there is a distinct interval between the end of inspiration and the beginning of expiration. Along with these changes an increase of vocal fremitus perceptible to the touch is a characteristic sign, and when the process affects the surface there is dulness on percussion, but in centric pneumonia, or pneumonia deep under the surface, these sounds may be scarcely appreciable.

There are many clinical resemblances between lobar pneumonia and erysipelas. Like erysipelas, lobar pneumonia begins at a definite focus and then spreads by contiguity, but in some, though not common cases, pneumonia appears in one place and then disappears from that to appear in another, and, like erysipelas, it is apt in succeeding years to occur with the same characters. Other forms of asthenic pneumonia occur in old people, so as to lead to the term "senile pneumonia" by some authors. Senile pneumonia is a very fatal form of the disease occurring in old people. It is often obscure in its symptoms, not accompanied by pronounced cough or expectoration, and often by a low grade of fever, its chief characters being systemic prostration with great feebleness of the pulse. These cases are sometimes complicated by abscess or by gangrene. The physical signs may be limited to dulness on percussion and to suppression of breath sounds. Due to these features the presence of pneumonia may be expected in all persons who, having fever, show marked change in their physical strength. Though all of these symptoms may accompany cough and bronchial secretion, and therefore lead to the diagnosis of bronchopneumonia, it is striking to find that in many of them the only organism present is Fränkel's pneumococcus. We should say, however, that, as in other infectious diseases, the rule is to find mixed infections with streptococci, staphylococci, and other organisms present in the terminal stages of life.

The Heart.—The pneumococcus when it causes pneumonia also causes much trouble with the heart. Of all the signs given by the pulse, the most ominous is a change in rhythm, whether it occurs early or late. I fully agree with Dr. Mackenzie that a change in this respect, that is, virtually an irregular pulse, presages death more than any one symptom. While the toxin of pneumonia produces parenchymatous

changes in the heart walls, these are not different from like changes in the cells of the kidneys and of the liver, but in pneumonia the difference in the behavior of the two ventricles of the heart is well marked. The left ventricle pumps its blood into the systemic arteries easier than it does in health, because the arteries are everywhere dilated. But the conditions confronting the right ventricle are wholly different. Besides its walls being thinner and weaker than those of the left ventricle, the obstacle of a hepatized lung throws increased labor upon the right ventricle, so that it may fatally terminate its function.

Moreover, the pneumococcus is prone to attack the pericardium. The occurrence of pericarditis, however, varies in different epidemics, some authors putting it at 12 per cent. in all cases of pneumonia and others at 50 per cent. This pericarditis is often difficult to detect from the concomitant presence of pulmonary râles and pleural friction sounds, so that its presence may be revealed only at autopsy. The seriousness of this complication depends upon the nature of the exudate, the least serious being when it is plastic, rather than serofibrinous, when the danger comes from its amount. The worst condition is when it is purulent, for then nothing but a surgical evacuation will avail.

Both acute and chronic endocarditis can be caused by the pneumococcus, and with many it is a fatal complication. The acute form is more common in patients above thirty than at an earlier age. The aortic and pulmonary valves are oftener attacked than the mitral and tricuspid. Such endocarditis may be overlooked on account of the uncertainty of its signs among those due to pulmonary or pericardial conditions. If, after a time, the clinical picture is that of a continuous fever or, worse yet, if the fever be intermittent and accompanied by chills, then ultimate death is well-nigh certain.

Treatment.—As to the treatment of pneumonia, one great indication is to supply the patient with all the fresh air possible. Whether the good effects here are due to the unfavorable action of oxygen on the growth of the pneumococcus itself, or to the property of oxygen to strengthen muscular function is uncertain, but certain it is that the chances of a pneumonia patient are better if his couch be put in a tent on the hospital roof than down in its wards.

Another indication is to avoid so far as possible all bodily movement. No acute case of the disease should be moved into a hospital over the rough pavement, for this is very often fatal. I do not allow a pneumonia patient to sit up for examination. I have often seen the lips become blue on merely turning the body from side to side, and when this has to be done, it should be as gently as possible. This

shows how critical the condition of pneumonia patients must be, simply owing to heart weakness. The best stimulant for heart failure is camphor given hypodermically in $\frac{1}{2}$ -gram or $7\frac{1}{2}$ -gr. doses dissolved in a syringeful of sterilized almond or olive oil, and which can be repeated in two hours if necessary. Strychnin is much inferior to camphor for this purpose. One authority recommends camphor hypodermically in doses two or three times greater than that above recommended as a specific in pneumonia.

In many cases the onset of pneumonia is accompanied by such severe pleuritic pain that the breathing becomes very hurried, short, and shallow, and for a time the aspect of the patient is that of a serious shock. At this juncture, but at no other time, a single dose of $\frac{1}{4}$ or $\frac{1}{2}$ gr. of morphin given hypodermically over the seat of the pain is of great service.

A different condition sometimes occurs at this early stage which is not now treated as successfully as it was in the days of our forefathers. That condition is one of rapid congestion of the affected lung, causing acute dilatation of the right ventricle with suffocative dyspnea. Because this state is promptly relieved by venesection, much more so than by leeches or by cupping, our predecessors were led to free bleeding in pneumonia as a routine practice through the whole course of the complaint. This was a serious error, but the fact remains that nothing so soothes the patient and improves the subsequent conditions as a single venesection when the signs above given indicate it.

After an experience of half a century in the treatment of pneumonia and after trying a great variety of remedies, I came in time to the belief that it did not make much difference what we use or what we do not use. Patients recovered or died just the same as they did one hundred years ago. But during the past fifteen years I have seen reason to change my mind. Both in hospital and consultation practice, including two severe epidemics of pneumonia, I have had a greater percentage of recoveries than before, owing, as I suppose, to the use of one drug, which among other effects changes the course of the fever, so that in 70 per cent. it ends by lysis instead of by crisis. That drug is creosote carbonate in 15-gr. doses given every two or three hours in a specially prepared emulsion, which is so well borne by the stomach that I have known it to stay down when everything else was rejected. The extreme susceptibility of the pneumococcus to the faintest trace of carbolic acid may allow of this preparation being regarded as a true blood germicide. I have seen no injurious effect produced by it even when its absorption causes the urine to become dark.

Surgeon-general Stokes of the United States Navy informs me that when he heard of my recommendation of creosote carbonate for pneumonia being given ten years ago at the New York Academy of Medicine he directed that this dosing of creosote carbonate should be used in all the ships of the United States Navy to pneumonia patients, in all parts of the world, on account of the favorable reports which he received of the results of this treatment compared with those of former years.

The prescription for this emulsion is as follows:

R.	Gum acacia.....	℥iv;
	Aquæ.....	℥ivss;
	F. mucil.	
	Creosotal.....ad.	℥v-℥xx;
M. ft.	Emulsio et adde:	
	Aquæ menthæ.....	℥iv;
	Glycerini.....	℥j;
	Aquæ.....ad.	℥viij.
Dose.—One tablespoonful, equal to 15 gr.		

Sometimes, after the crises the general condition of the patient continues unfavorable, marked by muttering delirium and by feeble pulse. This calls for special stimulants of the heart, of which the best is by keeping up the hypodermics of camphor every four hours along with a pill of 1 gr. of powdered squills, $\frac{1}{2}$ gr. of sulphate of spartein, and 2 gr. of caffein citrate. Occasionally, 15 drops of the tincture of nux vomica with a dram of the aromatic spirits of ammonia may be taken one-half hour after the hypodermics of camphor in sterilized almond oil.

TYPHOID FEVER

Of the acute, indirectly communicable diseases typhoid fever easily takes the lead, for it prevails the world over, in all seasons and in all climates. It is also an exclusively human disease, and, as we now know, though not contagious, its origin in every case is from some person, though he may be miles away.

Though probably of great antiquity, its identification as a distinct disease was late in history, owing to its confusion with other infectious fevers. In England, though typhoid fever was clearly described by Willis in 1643, it was generally regarded as a form of typhus fever down to the time of the younger Jenner in 1858. In France, on the other hand, it was plainly recognized, and its special lesions in the intestine carefully described, especially by Louis in 1829, but even he supposed that the continued fevers in other parts of Europe, which were undoubtedly typhus, were all one disease, and he, therefore, pro-

posed the name typhoid, or like typhus, for the complaint, a name which unfortunately it still retains. In England it is now frequently termed "enteric fever," but the objection to this term is, like all medical terms, based upon symptoms; it overlooks the fact that typhoid fever is a systemic blood disease, and hence may occur with very few, or even without intestinal lesions. The reason why France took the lead in this respect was because typhoid was the prevailing fever in that country, while typhus was rare. In England, on the other hand, both these fevers coexisted. It was really in America that the difference was first established, particularly by Gerhard, who, having studied under Louis, recognized typhoid in Philadelphia in 1835, and then followed an epidemic of typhus in the same city in 1836, so that he was the first to meet these two distinct fevers, face to face, and to discriminate them accordingly. He was soon followed by other American physicians, such as G. C. Shattuck, of Boston, while in 1842 Elisha Bartlett published the first treatise, in which the two diseases were discussed separately and distinguished from each other. The old confusion, however, died hard, for after I left the New York Quarantine, in 1861, I found myself almost alone at a meeting of the New York County Medical Society in maintaining that typhoid fever was not "abdominal typhus." In medicine, as in other things, it is easy to be wise after the events and wonder why people were not so before.

Etiology.—Typhoid fever is altogether due to its own bacillus, discovered by Eberth in 1880. It is an actively motile and flagellated organism 1 to 3 mm. in length and 5 to 8 mm. in diameter. It does not form spores. It is non-liquefying, growing best at 33° C. Its toxin, already mentioned, belongs to the intracellular group. This organism is killed by a temperature of 60° C., but cannot be killed by cold, even that of liquid air, and both freezing and thawing does not kill it. The agent of typhoid fever, like that of Asiatic cholera, must be swallowed to produce its effects, although it is claimed that the bacilli may be carried about by dust, yet they are not inhaled so as to infect the lungs, but pass from the mouth to the alimentary canal. The modes of its dissemination are so various that it is doubtful if any other communicable agent has so many ways for producing its infection. First in importance we would rate its distribution in drinking-water. These bacilli can live in distilled water for three months, but in water heavily charged with organic material they cannot live long, because they are attacked by other bacteria. The discharges from a single patient, sick with typhoid fever, contain so many millions of these bacteria that they may suffice to start an epidemic in a town

miles away from their original source, as is illustrated in the epidemic in Plymouth, Pa., in 1885. This town of 8000 inhabitants had its water supply derived largely from a stream on the watershed of which there were only two houses. It was found that in one of these houses on the stream there had been one patient ill with typhoid fever. At first the discharges from this patient were thrown on the snow and frozen ground, until the thaw came which washed the material on the surface into the stream. Soon after typhoid fever appeared in the town, and in a few days there were from 50 to 100 new cases a day; the total number in this town of 8000 amounting to 1104. Other instances of water-borne typhoid, both in small towns and large cities, might be multiplied indefinitely, as these bacilli are not affected by cold; so also they may become the means of infecting a town by receiving discharges on the ground during the winter months.

Next to water come articles of food, chief of which is milk. Milk is an excellent medium for the propagation of every kind of infection, because it is so well adapted for the culture of various forms of pathogenic bacteria. Milk infection, therefore, may account for the greater prevalence of typhoid fever in isolated rural districts than in the case of large cities. For the same reason, ice-cream may be the source of infection. Shell-fish are by no means an uncommon cause of outbreaks of typhoid fever, because the presence in them of typhoid bacilli has frequently been demonstrated. In one year I was called in consultation to 5 cases of this fever in a fashionable hotel in New York and to 7 cases in an adjoining hotel, and then to 12 cases in another well-known hotel, and, on examination, in every instance, I found that the persons affected were accustomed to have their first course that of raw oysters. Meanwhile, typhoid fever was not prevailing extensively in the houses among the better classes in the neighborhood, except in one instance, where I found a young boy and his nurse both down with typhoid fever, while the other members of the family escaped, the explanation being that only he and his nurse partook of raw oysters every day. In all these cases the oysters came from beds on Long Island Sound, which were infected by the sewage from the shore towns. On the other hand, oysters from the beds along the shores of Cape Cod, where there was no chance for such infection, were never the cause of typhoid fever, as was demonstrated by the New York Board of Health. Vegetables can be carriers of this infection only when eaten in an uncooked state, the vegetables having been grown on land which has been fertilized by infected material. Again, nothing can be more clearly demonstrated than that flies are very effective

agents for carrying this infection about their feet and then depositing it on every variety of food. Both in the Spanish-American War in America and in the South African Boer campaign, where there were great swarms of flies in the camps, examination showed that these insects were extremely effective agents in spreading the disease. Where the discharges of the patient contaminate clothing such articles may become dangerous, as is proved by the liability of laundresses who become infected. In my wards, in Roosevelt Hospital, I never allowed more than a certain number of typhoid patients to be admitted into a ward, because of the liability of the nurses, who were attendant, to contract this fever when they had too much to do in their duty. Such cases do not prove direct infection, but only that infection may occur where the conditions of crowding of the patients allow of the discharges remaining on the articles of clothing or bedding.

It is now clearly demonstrated that typhoid fever produces a true infection of the blood. This infection begins early, the highest percentage occurring in the first week, less in the second week, still less in the third week, and less again in the fourth week. In relapses the bacilli reappear in nearly every case. They are present in the rose-spots of the skin and in every gland. They have even been found in the brain, the spinal cord, and the meninges. In the lung they are usually accompanied by other organisms, also in the liver and spleen. The most important organs, however, for retaining the typhoid bacillus are the gall-bladder and the kidneys. In the gall-bladder the bacilli may remain living for years, and are not uncommonly the cause of the concretions which grow into gall-stones. It is difficult to account for their persistence, often in enormous numbers, in the urine for months, if not years after the patient has recovered from typhoid fever. These persons are called typhoid carriers, and may be the reason of unexpected outbreaks of this fever, which cannot otherwise be accounted for; which fact proves that the *Bacillus typhosus* may lurk everywhere where there are persons, and explains the universal prevalence of this disease where human beings come together.

Clinical Course.—The onset is rarely abrupt; the period of incubation is from eight to fourteen days or even more, quite commonly three weeks—onset is characterized often by a feeling of lassitude both bodily and mentally. Occasionally it sets in with chills, but the most common symptom is headache, which is continuous and often very severe, usually frontal, but sometimes occipital. The best remedy for this headache is phenacetin, 15 gr., with 2 gr. of caffein citrate. Not uncommonly there is some diarrhea at the onset, but

less frequently constipation instead. Vague pains in the abdomen are quite common. A persistent headache, with rise of temperature, is always a symptom indicative of infection. The fever in the great majority of cases advances slowly in the first week, falling in the morning and rising in the evening, perhaps gaining one degree in the morning every day until by the end of the week the morning temperature ranges from 102° to 104° F. The pulse at the beginning of the typhoid is often characteristic in being slow, relatively to the temperature. I have often strongly suspected typhoid when the frequency of the pulse in the first week was not much above normal, while the temperature was nearly 104° F., for no other febrile disease is apt to show such discrepancy. About this time the rash appears. In typhoid the pulse, even in the first week, is often dicrotic. In the second week the fever becomes more pronounced, the morning remission becoming slight and the pulse no longer dicrotic. At this time it is well to watch for the first signs of dryness at the tip of the tongue. Sometimes, but not commonly, hemorrhage of the bowels or even perforation occurs toward the end of this week.

There is no serious acute disease, which, as we shall see, is more amenable to treatment than typhoid fever, but, if not properly treated, its further course in the third week is marked by an increase in the pulse from 110 to 130. If it rises above 130, the prognosis is unfavorable in proportion to the rise. A degree of bronchitis may set in very early, so as to obscure the diagnosis. In unfavorable cases we may have pneumonia in the third week, with a constant diarrhea and tympanites, but one of the most serious symptoms is increasing feebleness of the heart. It is at this time that hemorrhage and perforation may occur. The fever continues high, from 104° to 106° F. A sudden drop then in the range of temperature is ominous, for it usually goes with the onset of hemorrhage. In the fourth week, as a rule, convalescence begins, but with a considerable variation in the symptoms, even in the milder cases. In severe cases the conditions are an aggravation of the symptoms of the previous week, the patient grows weaker, pulse more rapid and feeble, the tongue dry, and the abdomen distended. The delirium becomes more muttering and continuous, with subsultus tendinum, and the patients pass both the urine and feces in bed. Typhoid fever does not end by crisis, but by lysis, very gradually, and this condition may be vexatiously prolonged into the fifth or sixth week, even though there may be no pronounced relapse. True relapses usually occur after the temperature has come down to normal, or nearly normal, for two or three days. Then the picture of a new attack of

typhoid fever sets in, with the same gradual rise of the temperature with morning remissions until, in many cases, with a reappearance of the rash, it would be difficult not to pronounce the case as a second attack of this specific fever. As a rule, however, the relapses are shorter in duration and milder in their course than the original disease. The physician, however, should be guarded in his prognosis, for in numerous instances death occurs during the relapse, usually from progressive weakness or from perforation.

Rather extensive changes occur in the arteries, the most important of which are located in the aorta and in the coronary arteries, and consist of turgescence of the intima with scattered areas of deeper degenerations, which may lead to necroses in the parts supplied by the affected arteries. The veins show changes more frequently than the arteries, thrombosis of veins being particularly common. We may have ulcers in the esophagus with a few above in the pharynx.

There may be extreme emaciation along with bed-sores, both of which are preventable by proper treatment. The muscles are very prone to degeneration due to prolonged course of the fever, but otherwise the changes in them are not characteristic only of this disease. As in other fevers the nervous symptoms may be very pronounced; these are caused by no organic changes in either brain or spinal cord, but are altogether due to the toxemia. Meningitis is uncommon, but does occur sometimes accompanied by purulent exudation. A thin exudation may be found at the beginning in severe cases on the tonsils and on the uvula and soft palate. The larynx is sometimes infected, beginning with superficial inflammation of its mucous membrane, which may penetrate deeper with ulceration and then affect the cartilages. The majority of the ulcers are on the posterior part of the larynx, but may also be at the base of the epiglottis. When the cartilages are involved, then necrosis may give rise to serious abscesses. Such inflammations do not extend to the trachea and bronchi. Hypostatic pneumonia usually occurs from too prolonged decubitus. Lobar pneumonia, on the other hand, is not uncommon, and may be due to its usual agent, the pneumococcus, but occasionally has been found to be due to the typhoid bacillus. In my experience the prognosis of such pneumonia is not very serious. Bronchopneumonia is very common as a sequel to early bronchitis. This bronchitis is so common at the onset as to delay the diagnosis of typhoid fever. Gangrene of the lung occurs as a sequel to pneumonia, but is not common. Hemorrhagic infarction, especially during the later stages, is not uncommon. The important cardiac changes are in the myocar-

dium, and may constitute the most serious of the complications of the later stages of the disease. Death, in fact, is often due to this condition of the heart, the heart-muscles showing on section marked parenchymatous degeneration, with a curiously characteristic mottled appearance. Endocarditis is rare; so also is pericarditis.

The *rash* of typhoid fever is quite distinctive and differs from the eruptive forms of other exanthemata, like scarlet fever, measles, and small-pox. It is usually not nearly so extensive, and its rose-spots may have to be carefully looked for and distinguished from ordinary papules or spots on the skin. It also has no certain date for its appearance, usually occurring at the end of the first week, though sometimes not until in a relapse.

Its most common site is on the anterior abdomen, but frequently on the back. I have seen it, however, all over the body. It consists of definitely outlined rose-spots, as they are called, which disappear on pressure, but return quickly when that is removed. The typhoid bacilli have been found in these spots, one evidence of the universal distribution of the infection. These spots after disappearing may develop in other localities. The organ earliest affected is the spleen, which is invariably enlarged in the early stages of the disease, and this enlargement constitutes one of the diagnostic symptoms of this infection. This is due to a congestion of the tissue, which also produces softening of its parenchyma, so that the organ may spontaneously rupture.

By far the most serious of typhoid changes occur in the intestine, in which the lymphoid elements chiefly at the lower end of the ilium are involved. These begin with a hyperplasia, implicating the glands of Peyer from the jejunum down, but chiefly in the lower end of the ilium, and, to a variable extent, in the large intestine as well. A great increase and accumulation of the cells in the lymph tissue occurs, as if this tissue were especially stimulated by the typhoid toxin; the cells may so crowd upon one another that the circulation and nutrition of the part is gravely involved, leading to patches of ulceration which may be very irregular or extensive. It is from these ulcerations that the more serious accidents, such as intestinal hemorrhage and perforation, occur. Both these accidents of hemorrhage and of perforation vary remarkably, according to seasonal changes in the epidemics, the causes of which are obscure; during some years, in my wards, these accidents were three or four times as numerous as in other years. One feature, however, in typhoid intestinal ulcerations is that in healing, the ulcers leave scarcely any scars, and do not produce constriction

of the bowel as they do in tuberculous or other ulcerative conditions of the intestine.

Treatment.—When left to itself, or imperfectly treated, typhoid fever is a very serious complaint. Thus, Dr. Murchison found that the mortality of patients in the London fever hospital, during the ten years ending 1862, was 18.5 per cent., and Dr. Sidney Phillips, in a paper read before the Harveian Society in November, 1899, from comparison of statistics of the London Hospitals from 1890 to 1897, stated that the mortality still remained nearly 19 per cent. This is in striking contrast with the extensive experience of Jurgensen, in the management of this fever among German army recruits, in which he puts the mortality at but little above 2 per cent. According to my recorded experience in hospital practice for the past thirty-five years, the mortality should not be much over 3 per cent. Among those patients, who gave us an opportunity to treat them, I make this statement with full recognition of the fact that no such conclusions should have weight, unless they are based upon carefully made and recorded observations extending over long periods.

Typhoid fever shares with other acute infections a varying severity, according to what is termed the epidemic constitution of the particular season, rendering the experience of one year no criterion of what it will be the following year. Hospital statistics are notoriously untrustworthy for drawing any conclusions as to treatment, because so many of the patients with typhoid fever are not brought to the hospital until they are far advanced in the disease. Thus, of 574 patients in my wards at the Roosevelt Hospital, 398 males and 176 females, with a total number of deaths 40, or 7.5 per cent. of the entire number, 23 or 57 per cent. died within the first week after admission, and 80 per cent. of these did not survive the fourth day, while no less than 7 succumbed to perforation within four days after admission. Statistics of mortality, however, are not the only test of the efficacy of any method of treatment, and particularly so in typhoid fever. How the patients pass through the attack, in respect to the occurrence and to the gravity of its various accompaniments, and in what condition it leaves those who recover from it, are much more satisfactory indications, whether the disease is amenable to certain remedial measures or not. Whether any progress, therefore, has been gained in the past thirty-five years in the management of typhoid fever would be best illustrated by a comparison between the incidence and the degree of the leading symptoms of typhoid fever, as they are described in such text-books as Watson and

Bristowe's of forty years ago and those found in the clinical histories now presented. Thus, following Bristowe's enumeration of symptoms, we shall first note the diarrhea. He speaks of it as generally associated with the initial symptoms, though sometimes absent, then to become a striking feature of the disease, and rarely absent from the second week on. He recommends to check it by the systematic administration of tannic acid, sulphuric acid, lead and opium, etc.

In my own records diarrhea occurring after the first week is reported in only 39, or 12 per cent., and in the majority of them it was not severe, so that there are very few prescriptions recorded as administered for this symptom. On the contrary, constipation, which has to be relieved by enemas, was a frequent occurrence. I ascribe this change, in a large measure, to a change in the feeding of the patient. Thirty years ago the use of beef-tea in typhoid fever was almost universal. I believe that hardly any articles are so prone to fermentation in the alimentary canal as the continuous administration, day and night, of meat broths in febrile conditions.

Thirty years ago tympanites was so constant a symptom that it was rated as a diagnostic feature of the disease. Dr. Jenner states that the shape of the abdomen is invariably the same and peculiar. The patient is never pot-bellied, but tub shaped. As I have always placed a good deal of store on this symptom I have had its occurrence noted in every case, so that even its temporary presence might not be overlooked. I was somewhat surprised, therefore, to find it recorded in 101, or 28 per cent. On reviewing this record, however, it was found that about 40 per cent. of the whole number of instances of tympanites occurred in September and October, 1898, and were noted in 39 soldiers admitted for typhoid fever contracted during the Spanish-American War. It was probably owing to the reduced physical condition of these soldiers, from the poor food and other hardships of camp life, that they so generally presented this symptom on admission. Deducting, therefore, these soldiers, the occurrence of tympanites is recorded in only about 62 patients or about 26 per cent. Its presence is generally noted in the histories of those who were admitted late in the disease, and in the majority of these it disappears soon after under treatment. The prevention of this particular symptom, I believe, not to be without bearing on the question whether we can favorably modify the course of the fever, for tympanites is both a sign and a complication. It is a sign of weakened innervation and loss of the normal antiseptic power of the gastro-intestinal secretions, and also the direct cause of cardiac and of pulmonary circulatory enfeeble-

ment on the other, while it cannot be without some effect in increasing the tendency to accidents, such as hemorrhage and perforation, at the seats of intestinal ulceration. I always regard a persistent tympanites in a typhoid patient with uneasiness, and any treatment in which this symptom becomes a rarity I cannot but consider as materially beneficial.

Hemorrhage from the bowels occurred in 1 per cent. In no instance was it directly fatal, and it was readily controlled by a dose of 3 pills at once administered of the following prescription:

R. Argent. nitratis.....	gr. v;
Pulv. opii.....	gr. v;
Terebinthinæ resin.....	ʒiij;
Liq. kali.....	ʒj.—M.
Div. in pilul. lx.	

The object of the turpentine is to prevent the silver salt from being absorbed until it is well on its way down into the intestine. Sometimes these pills are voided unchanged, in which case they are rubbed up with more licorice powder in the making. I have used these pills for years in the treatment of ulcerative colitis or ulcers in chronic dysentery, intestinal tuberculosis, etc., with such good effects that I have no doubt that when taken for intestinal hemorrhage they may also be of service in preventing perforation. After there have been no signs of hemorrhage in typhoid for thirty-six hours the baths are again resumed. It is always, however, a complication of some moment, because it may oblige us to suspend the Brand bath at a critical period of the hyperpyrexia.

In the third and fourth weeks the patients are often restless from a general aching of the body. This is due to the absorption of the subcutaneous cushion of fat, leaving the nerves which never waste so exposed to pressure against the bones at the sacrum, scapulæ, knees, etc., that intolerable neuralgic pains often result. This aching is remarkably relieved and sleep thereby promoted by spreading sheepskins with the wool on them or buffalo robes on the bed and over these a sheet for the patient to lie upon. In all conditions of emaciation such measures to relieve pressure on nerves should be employed. Rubbing the patient all over with warm lime-water liniment, to which cinnamon oil, 1 dram to the pint, has been added, is very soothing after the second week, and if well applied to the back twice a day is a good prophylactic against bed-sores.

One man, while sitting up convalescent on the thirty-second day of

his disease, began to bleed from nearly every mucous membrane of his body. He died after two days from excessive hematuria.

Among the 31 deaths of male patients, 7 succumbed to intestinal perforation. One of these cases was that of a boy who had been in the hospital ten days. All the others occurred in patients who had been there less than a week after admission. The boy was operated upon and recovered. Five others were operated upon, but died.

To continue our comparison with descriptions of former text-books, Dr. Bristowe proceeds to describe the classical typhoid condition, into which he states a large proportion of the cases pass in the second week. The elevation of the temperature continues, the rash still comes out, the diarrhea still persists, the tongue becomes dry and brown and traversed by deep fissures, the lips and teeth covered with sordes, the mind grows dull and apathetic, and delirium, sometimes violent, sometimes busy, sometimes muttering, supervenes. Tremors, subsultus and involuntary passage of evacuations take place, etc.

I have no hesitation in saying that our present forms of treatment have done away with the typhoid condition here described so entirely that repeatedly my successive house physicians have told me that they had not seen cases of the kind and would have to go elsewhere to find them. That this picture of a patient's state should become a rarity is certainly an evidence of improved therapeutics, as is shown by the following reports of the incidence of its constituent symptoms. Thus, as to delirium, out of the whole number admitted to my wards it was noted in 60, or 16 per cent., but of these 26, or nearly 50 per cent., were delirious on admission, 12 of whom died within that week, whereas the rest recovered from their delirium within a week or less. The absence of delirium at any period of their illness in the remaining 517 patients, or 94 per cent. of the whole number, is at least an indication that they hardly passed into Bristowe's typhoid state at any time in the course of the disease; while nothing testifies so clearly to the benefits of treatment as the absence of all signs of mental disturbance in the majority of these ward patients. The state of the tongue was always carefully noted, but fissure is not once recorded; sordes on the teeth and lips were present in some patients on admission, but soon disappeared, and is never recorded as developing in patients after admission. The following remedy is efficacious in preventing dryness of the tongue if given on the first appearance of this symptom at the tip: Oil of turpentine in the ordinary emulsion of gum arabic, in tablespoon doses, each tablespoon containing from 10 to 15 drops of turpentine. These doses may be given twice a day.

Of other complications in our series pneumonia occurred in 11, or

1.9 per cent.; bronchitis, in 56, or 18 per cent. It was an initial symptom in over 40 per cent., but was easily controlled.

Peripheral neuritis occurred in 28 or not quite 7 per cent., and in each case was limited to the feet. The causation of this symptom in typhoid is apparently purely mechanical from the foot-drop induced by prolonged relaxation of the leg muscles, thus causing the nerves to be put upon a continuous stretch and, therefore, I am always particular that the feet have a foot-rest in the third week, with care that the weight of the bedclothes should be taken off them by a cradle. Neglect of these precautions may make the recovery of the power of walking very slow during convalescence. The best local application to relieve the tenderness and pain in the feet is to wrap them up twice a day, for half an hour, in cloths wet with an infusion of red pepper, 1 dram to the pint of hot water.

Phlebitis occurred in 11; in 2 of them it was very troublesome and much prolonged in convalescence. Local applications of the strong tincture of iodine or of silver nitrate, 20 gr. to the ounce, should be applied over the affected vein very early.

Relapses occurred in 62 or no less than 18 per cent. of all cases, though some of them seemed to occur in close sequence to some imprudence in eating during the hungry period of convalescence, yet in many instances no such cause could be assigned. Moreover, the tendency to relapse is much more marked in certain years than in others, rising in one year to 30 per cent. of all cases, so that the etiology of these recrudescences is obscure. It seems to me, however, that relapses are more frequent in that class of patients in whom the brunt of the attack appears to fall on the intestine, more so than with those characterized in the beginning with a tendency to hyperpyrexia. A patient with the symptoms of pronounced abdominal lesions, such as persistent tympanites and tongue tremor, should not be allowed solid food in any form for ten days after his temperature has fallen to normal.

The treatment of typhoid fever should be of a general kind, to be prescribed, in all its details, for every case from the beginning, no matter how mild the attack may seem to be, for we are never sure that a mild case may not develop severe symptoms. The treatment also should be of a particular kind, according to the special tendencies developing in the course of the disease. Those special tendencies should be early recognized and definitely dealt with, for routine treatment is no more justifiable in typhoid than in any other serious complaint.

The *general line of treatment*, which in the majority of cases is the only treatment needed, I would prescribe as follows:

First, early attention to the state of the kidneys during the first week or ten days, as there is a marked tendency to a diminution in the secretion of urine. This I regard as an initial complication, whose effects may render the subsequent course much more severe perhaps by favoring the increased multiplication of the typhoid bacillus in the blood, owing to the retention of excrementitious matter from the early failure of renal eliminations.

Late researches show that the typhoid bacilli, instead of developing only locally in the intestine, may charge the blood as early as the end of the first week. I would recommend, therefore, a recourse in these cases, for the first two weeks of the fever, to the most certain diuretic which we possess, namely, rectal irrigation with hot normal saline twice a day. Kemp's rectal irrigator is the best instrument for this purpose that I know of, using with it 4 gallons each time at a temperature of 115° to 120° F. The flow should run out as fast as it runs in, and it so constantly increases the urinary secretion that I have no doubt, from numerous comparative observations between those who had it and those who were without it, the course of the fever is distinctly changed for the better by this measure.

In some cases acute nephritis develops comparatively early in the disease, and then constitutes a serious complication, with a tendency to death from uremic coma with pulmonary edema, the causation of this complication being a septic invasion of the kidneys by the *Bacillus coli*, and should be promptly dealt with by the administration of 10 gr. of urotropin along with 10 gr. of sodium benzoate. It is striking to note how soon this remedy lessens the percentage of albumin in the urine, and also lessens the number of casts. Urotropin and sodium benzoate, in 10-gr. doses four to six times daily as a blood disinfectant, prevent colon bacillus and indicanuria, also disinfecting the urine, thereby lessening the chance of becoming typhoid bacillus carriers.

One of the best procedures in the first stage of the fever is intestinal disinfection by a calomel purge, given every other night, until the middle of the third week. My usual dose is 5 gr. of calomel and 35 gr. of compound jalap powder. It promptly stops diarrhea, if that be present, and is remarkable for lowering the febrile temperature in the second week often from 1 to 3 degrees, compared with its previous range. It acts well also in the promotion of the secretion of urine. It should be omitted, however, after the twentieth day, owing to the risk of hemorrhage from cathartics.

The next measure which I would mention is the systematic use of the cold bath, sometimes called the "Brand." I might almost say that without this bath I would hardly try to treat a severe case of typhoid fever. The reasons for this measure should be clearly stated. Careful observations, in every part of the world, have shown that a chief result of the cold bath is greatly to increase the toxicity of the urine passed immediately after the bath, thus showing that the bath causes active elimination by the kidneys of poisons in the blood. It is, therefore, by no means only through the reduction of temperature that the cold bath is so beneficial. One effect of immersing the body in cold water is at first to raise the temperature, which rise is caused by the cool blood of the surface being driven into the internal organs, whose temperature is always from 1 to 3 degrés higher than the temperature of the surface. It is always well to begin with a bath the temperature of which is not lower than 97° F. so as to prevent shock. While in the bath, the attendant should actively rub the patient, and this measure should never be omitted. Meantime, by a thermometer placed under the tongue, the temperature should be read every two or three minutes, to be ready to remove the patient whenever a fall of 2 to 3 degrees in four minutes has happened; because in every case the temperature goes on falling after the patient has been returned to bed, especially in the case of children. Application of cold to the head while in the bath should not be neglected, preferably by an ice-bag, wrapped in one or two layers of cotton cloth. The beneficial effects of the bath, when properly administered, are unmistakable. If delirium has been present, this subsides, and not infrequently the patient falls into a short, refreshing sleep, while the pulse improves and he grows calmer. The subsequent course varies with each patient. In severe cases the fever soon returns, so as to reach 103° F. in an hour. In many cases of hyperpyrexia I have ordered twelve baths in twenty-four hours before the fever would give in. With these precautions (above detailed) one need never fear giving too many baths. In one case I kept the patient in the bath for thirty-seven minutes before the temperature would fall, but then it came down, and from then on he made an uninterrupted recovery. Ordinarily, however, patients do not require more than four baths a day. The rule still remains the same as at the beginning, that so soon as the temperature reaches 103° F. the bath should be resumed. It is not uncommon for attacks of shivering to come on before or when the patient is taken out of the bath. This is best treated by giving a teaspoonful of Hoffmann's anodyne or compound spirits of sulphuric ether in an ounce of camphor-water.

One consideration of prime importance is to maintain the nutrition of the patient throughout this wasting fever. The patient after the usual course of four weeks of this fever should ordinarily appear emaciated, but I have often heard it remarked by visitors that my typhoid cases could not have been very sick because they looked so well. But under ordinary treatment they are frequently so much reduced and emaciated that bed-sores form on the sacrum, scapulæ, or where the knees come together, all due to the disappearance of the subcutaneous cushion of fat which protects the skin from pressure by the subjacent bones. In some cases which were admitted late in the disease the skin along the back already showed signs of incipient bed-sores. For these I would prescribe an ointment composed of 1 dram of tannate of lead, with 2 gr. of salicylic acid to 1 oz. of simple cerate, to be spread thickly on a cloth, and the whole covered with cotton batting, to take off the pressure.

The first indication, however, is properly to feed the patient. It should be remembered that typhoid fever, as shown by Fenwick, destroys the property of the stomach to secrete pepsin more than any other wasting disease, not excepting phthisis or gastric cancer. The stomach of the patient, therefore, is reduced to more than the weakness of infancy for digesting milk. Milk, however, is the only food that we can use with safety, and it should be prepared so that the patient can take it continuously. I have directed that equal parts of milk and lime-water should be administered night and day, in wine-glass doses, to be repeated as often as the patient will take it. Besides the milk and lime-water the patient should take 10 gr. of saccharated pepsin and from 10 to 20 gr. of bismuth subcarbonate every three hours through the twenty-four. No other medication is usually prescribed.

I rarely prescribe alcohol in any form in the treatment of typhoid fever. Occasionally, however, with those admitted late in the disease, it is necessary. It is a common mistake to give alcohol too continuously during the complaint. It should be administered only occasionally, and then in actually stimulating doses of from $\frac{1}{2}$ to 1 oz. of whisky in the milk and lime-water. My custom is to direct it only after 3 o'clock in the afternoon, if not to postpone it altogether until after midnight. In conditions of great weakness of the heart, strychnin and caffein may be tried. But the real heart stimulant to sustain this failing organ the best is the hypodermic injection of camphor in sterilized almond oil, as before mentioned.

During the convalescence it is important to know when and how long the patient may be allowed to sit up. Many sudden deaths

have occurred from cardiac weakness in convalescents, and I have known of more than one instance of permanent injury to the heart from patients rising and going about too soon after typhoid fever. The safe rule is to take the pulse of the patient while he is lying down, and then counting the frequency when he sits up. Normally, the pulse should increase only 10 beats on rising, but if it increases 50 beats he should not think of sitting up or walking. I kept a patient once for two months in bed because his pulse-rate would not fall to the normal ratio between the recumbent and erect posture.

Antityphoid Inoculation.—Smallpox was formerly the terror and scourge of all civilized countries until it received its quietus by the immortal discovery of Jenner in 1796, who proved that by simple vaccination it might be suppressed. Now typhoid fever is destined to meet the same fate by means altogether similar to vaccination.

It is from armies, originally equipped for the destruction of their fellow-men, that we are now supplied with the best information how human lives may be saved. So recently as 1898, in the Spanish American War, there were 107,973 men of the volunteer army collected in camps and not yet engaged at the front. Of these, in six months no less than 20,738 cases of typhoid fever occurred, with 1580 deaths. Meantime in the years 1912 and 1913 antityphoid inoculation was made compulsory in the United States Army, with the result that in 1912 out of 88,478 soldiers only 8 cases of typhoid fever occurred, with no deaths, and in 1913 out of 90,646 men only 1 case occurred, and he recovered.

The profession owes to Sir Almroth E. Wright the discovery of the means of preventing infection by this typhoid bacillus. The material used is a bouillon culture of the *Bacillus typhosus* which is grown for four weeks and then sterilized by heating to 60° C. for ten to fifteen minutes. About three inoculations are given in all. For the first injection 500,000,000 of dead bacteria are used. Ten days later 1,000,000,000, and ten days later 1,000,000,000 more. The United States Army claims to have the best vaccine, but the preparation of the New York Board of Health is also good. About five to six weeks after the last injection it would be well to try the Widal reaction, because if it be present it would demonstrate success.

Meantime some precautions should be taken while the inoculations are in progress. All alcoholic drinks should be avoided, both for a week before and two weeks after the inoculation. With many no serious symptoms follow, only a little headache or malaise, and if the inoculations have been made in the upper arm, the whole arm down to the wrist may be slightly tender for a few days. In others a febrile condition similar to serum sickness may supervene, in which the

temperature rises to 101° or 102° F., and in exceptional cases to 103° F., with chilliness and pains in the joints. But after a day or two everything subsides.

It is yet too early to decide how long the protection lasts, but, unlike vaccination against smallpox, it is not for years, and most authors agree that the immunity may only last two years. But even if it relapses, the inoculation serves to diminish the severity of the attack, just as smallpox vaccination causes in after years the original variola to be changed into milder varioloid.

PARATYPHOID FEVER

Besides the typhoid bacillus there are other related organisms which cause their own special disorders. First among these we would mention the paratyphoid bacillus, which causes a fever very closely resembling typhoid fever, both in its symptoms and its course. The differential diagnosis from typhoid fever can only be settled by an examination of the blood, which will show the presence of the paratyphoid bacillus. This organism presents characteristic differences in culture-media from Eberth's bacillus, and, clinically, the fever which it occasions differs from typhoid fever in running a much shorter course. Formerly, owing to this fact, cases were frequently mentioned of abortive typhoid fever, because paratyphoid fever can run its course in from ten to fourteen days, and usually that course is milder than uncomplicated typhoid fever. In treatment it differs in no respect from that caused by Eberth's bacillus.

MEAT-POISONING

Very different and far more serious in its effect is the derangement caused by Gärtner's *Bacillus enteritidis*. This organism has been identified as the cause of several local outbreaks of meat-poisoning, so named because the patients have partaken of the same kind of butcher meat, whether beef or pork. The symptoms of this infection are violent derangements of the intestine, frequently with discharges of blood, and rapid involvement of the nervous system. This affection was first identified by Gärtner, who, besides demonstrating its origin from a particular bacillus which he called "*Bacillus enteritidis*," was able to isolate its toxin, which is remarkable for its great resistance to heat. No antidote to this bacillus has yet been discovered.

ASIATIC CHOLERA

In the year 1885 the Massachusetts Board of Health issued a statement intending to reassure the public about the nature of Asiatic

cholera which then began to be epidemic in Boston. In this statement they strongly insisted that Asiatic cholera was not at all a contagious disease, but was due to a miasm pervading the atmosphere. Both these statements were mischievous errors, because it was then understood that in denying that Asiatic cholera was contagious it was also intended to deny that it was communicable from person to person, whereas the truth is that this disease, though not properly contagious, is always communicated from the sick to the well. We know also that the second statement was equally erroneous, as there is no miasm; for even the disease called by its ancient name—"malaria" or bad air—we now know is an infection caused solely through a hypodermic injection by a mosquito. The whole conception of the deadly miasms arising from swamps and unhealthy localities, which for ages has weighed upon the medical mind, is a mistake, and therefore there are no unhealthy localities or unhealthy climates as such, but only regions infected by a certain variety of mosquito, which medical science knows now how to disinfect and render as healthy as any other climate.

Had the Massachusetts State Board of Health only perused the reports published by the Government of Denmark on the epidemic of cholera in that kingdom in the year 1853 they would at once have known, as the profession ever since has known, that cholera does spread from person to person and in no other way, and is never disseminated through the atmosphere. This was proved by the Danish Government issuing directions to all physicians practising in country districts in Denmark to report the first case of cholera occurring in their rural neighborhood. Then the second, third, and fourth, up to the fifth case was reported. Having collected these reports, it was shown that the case of each second, third, and fourth patient could in some way be traced as having had some communication with the first patient; although in one instance a laundress who had washed the clothes of a cholera patient was taken sick, though she never saw the patient and lived ten miles from him.

This leads me to say that this fact affords a valuable illustration of how country practitioners may greatly assist their profession by systematic observation of the epidemic prevalence of certain infections when occurring in isolated communities. They may be the only men who can give satisfactory observations on many infections, such as epidemic poliomyelitis, compared with those who practice in large cities where crowds are often assembled, making it impossible to detect infected persons, compared to patients in country districts where every one can personally know his neighbors.

Asiatic cholera is, like typhoid fever, a typical illustration of an infection indirectly communicated, and hence not at all contagious. Its chief clinical feature is a rapid draining of the blood-serum produced by abundant evacuation from the bowels as well as by vomiting. It is interesting to note that experimental excision of the solar plexus is followed by a diarrhea closely resembling that of Asiatic cholera. As we know that the specific agent of cholera does not enter the blood, but grows on a large scale in the intestine, it would seem as if a cholera toxin absorbed by the blood causes a paralysis of the abdominal sympathetic.

The identification of the causative agent of cholera was made by Robert Koch in 1883, and his name will always be celebrated for those two great discoveries of the *Bacillus tuberculosis* and of the cholera germ within the short period of three years. Koch conclusively showed that this disease is caused by a microbe which he called the comma bacillus, which is a short, somewhat thick and curved organism closely resembling a comma in writing. Sometimes two of these bacilli are joined by their bases so as to resemble the letter "s." Its toxin is intracellular. It grows in vast numbers on the mucous surface of the intestine, but in chronic cases digs down into the Lieberkühn follicles. In the flux are suspended portions of the shed epithelium, so as to give rise to the term "rice-water discharges."

There can be no doubt that cholera has existed in its native haunts in India from remote times, yet it is difficult to account for the fact that it did not take the form of a world epidemic until the year 1817. Since that time it has repeatedly invaded all countries in Asia, Europe, Africa, and America, its march being from east to west, and strictly following the routes of commerce or, in the Oriental lands, the tracks of pilgrimages.

The present generation hardly knows how the dread specter of this epidemic once made all the western nations tremble when the news came that it had started afresh on its travels from its native India. The British Government had discovered there that its chief outbursts coincided with the great Hindu pilgrimage which occurred once in twelve years to Hardwar, on the Ganges. How cholera might abound on such an occasion is well shown in the description by Dr. Simpson, the able health officer of Calcutta: "At this pilgrimage, which is also held as a fair, from 800,000 to 1,000,000 Hindus collect to drink the holy waters of their sacred Ganges, and to bathe in the great tank constructed at the riverside. From April 8 to April 12, 1891, it presented the spectacle of a seething mass of humanity in constant

motion through the pool at the rate of 400 to 500 per minute." Now it can easily be imagined that a few cases of cholera introduced into such a multitude would easily induce not only an outbreak of cholera there and then, but would be carried far and wide by returning pilgrims. Thus a sanitary commissioner says of previous Hardwar gatherings that very little remains on record, but *that little* is a record of disease and death. So grave was the outlook that the question of prohibiting the pilgrimage in 1891 was seriously discussed, and many officials of great experience reported that the most complete sanitary arrangements would be powerless to prevent the spread of cholera if the fair was held.

As this prohibition might entail the danger of a general insurrection, the British Government decided to hand the management of it over to the Indian medical staff. The latter, now knowing just how cholera infects, and that, without being swallowed in food or drink, it cannot travel six inches, allowed the fair to be held. They promptly removed to appointed tents every case of the disease in this Asiatic crowd as soon as reported. All discharges from the patients were quickly disinfected, with the result that the cholera was stamped out as effectually as a fire can be extinguished if taken just at its beginning.

Like typhoid fever, it is a water-borne disease. This was strikingly illustrated in the great epidemic in the city of Hamburg in 1892. The inhabitants on one side of a street were severely affected, while those on the opposite side of the street almost wholly escaped, the explanation being that houses of the affected side were supplied by the contaminated water of the river Elbe, while on the other side the houses were supplied by the uncontaminated aqueduct of the suburb Altuna.

Symptomatology.—The course of the attack may be divided into three stages: the first is that of diarrhea, commonly painless, but sometimes accompanied with considerable griping. The next stage is that of collapse, which may follow in only a very few hours, though ordinarily it continues for the greater part of the day. In some, however, the poisoning is so overwhelming that the patients die outright without any diarrhea. These cases are called cholera sicca.

Along with the purging there soon follows profuse vomiting, in which the stomach contents present are first ejected, to be followed by great quantities of a tasteless fluid. Soon afterward the patient passes into a state of typical collapse similar to that accompanying fatal hemorrhage; in fact, the patient, in one sense, does bleed to death, for the vomiting and purging so deplete the blood of its serum that the remaining corpuscular elements of the blood cause it to become very concentrated. This leads to another characteristic symptom of painful

cramps of the muscles, particularly of the extremities. It should be borne in mind that in every case where the muscles are rapidly deprived of blood, tonic muscular cramps are induced. In this stage, as might be expected, the pulse becomes very small and then hardly perceptible at the wrist. The temperature falls, and in the axilla may not be above 90° F., though in the rectum it may be 103° F. or more.

Similarly, the respirations become hurried and shallow, and the voice husky, if not suppressed. The effect on the brain varies: in many cases the intelligence is preserved to the last, the patient showing a peculiar apathy, while in other cases coma sets in early.

If the patient recovers from the state of collapse, the pulse begins to return to the wrist, the features, which have become shrunk, resume their natural aspect, and the cold, clammy surface again feels normal. This stage of reaction, however, is often accompanied by dangers of its own, for the kidneys, whose secretion has been entirely suppressed during the state of collapse, may fail to perform their natural functions, and acute nephritis involving the tubules and parenchyma supervenes; so death is caused by uremia. Other accidents also develop in the parenchyma of different viscera, especially the liver, so that while many cases recover rapidly from the disease, with others the convalescence is very tedious.

The mortality in this formidable epidemic is always high, ranging from 20 to 80 per cent. of those attacked.

Treatment.—We have no antidote against cholera any more than in other fatal infections which cause death by the absorption of the toxins rather than the infecting agents themselves. What we can do is to deal with the complications, and whatever we attempt must be done promptly, for the time rapidly passes in which we can do anything. The first of these complications is heart failure in the stage of collapse, and for this purpose our only recourse is to hypodermic injections of camphor in sterilized almond or olive oil. These injections should contain $\frac{1}{2}$ gram or $7\frac{1}{2}$ grains of camphor to the syringe-ful, and may be repeated every two hours. The next complication is the drainage of the blood of its serum, caused both by the purging and the vomiting of the disease. The most effective measure for this is by hypodermic enteroclysis. For this purpose 8 oz. of normal saline can be slowly injected into the abdominal tissues of either flank of the abdomen. Along with this, notwithstanding the purging, attempts should be made to administer 1 to 2 gallons of normal saline by Kemp's rectal irrigator, for, however active the diarrhea, this measure will allow of a certain amount of absorption of the saline by the blood. It may

be well at this time to try to allay the peristalsis of the bowel with hypodermic injections of morphin, the dose of which is to be left to the discretion of the physician. In the after-treatment of the case the most serious complication is in the condition of the kidneys, and here, again, the persistent use of the rectal irrigator should be continued. Toward the end of this treatment the irritability of the stomach may be allayed by drop doses of Fowler's solution of arsenic, given every fifteen minutes until six doses have been taken.

ANTHRAX

Anthrax is particularly interesting as the first disease whose specific micro-organism was identified by Rayer and Davaine in 1850. It is a disease which is transmitted to man from animals, and is also remarkable for the survival of its spores, which are not killed by a number of disinfectants invariably fatal in other infections. Due to the resistance of its spores, the carcasses of infected animals should be burned, because though buried deeply in the ground they have nevertheless caused infection of cattle. On that account Pasteur suggested that the disease is propagated by earthworms infected at different levels under the ground. In man the infection comes accidentally to those who handle the hides or wool of animals who have died from the disease, and hence it was known for some time in England as woolsorters' disease.

The appearance of its bacilli is very distinctive, being often the length equal to the diameter of a red blood-corpuscle. They are non-motile and occur either singly or in groups. As seen in man, they appear on the surface of the seat of inoculation as pimples, which soon become vesicular with an angry and infiltrated base, the tissues around them rapidly swelling, with a tendency to gangrene of the summit, surrounded by a purplish eschar and a spreading zone of infiltration, rendering it quite diagnostic, the name then often given to it being malignant pustule. When the pustule first forms with its circumjacent edema the temperature may rise rapidly, but within twenty-four to thirty-six hours it falls, in many cases below normal, without any alleviation of the constitutional symptoms. These vary, those of the gravest toxemia causing death in less than two days, with great swelling of the affected parts, so much so as to cause local gangrene. The pulse is very quick and feeble and all the constitutional symptoms are of an adynamic character. In milder cases the papules are smaller and end in lighter eschars with less edema or implications of the deeper parts.

Intestinal Form of Mycosis Intestinalis.—In these cases the infection usually is through the stomach and intestines, and results from eating the flesh or drinking the milk of diseased animals. It may follow an external infection if the germs are carried through the mouth. The disease may set in with a chill, followed by vomiting, diarrhea, moderate fever, and pain in the legs and back. In acute cases there are dyspnea, cyanosis, great anxiety and restlessness, and toward the end convulsions or spasms of the muscles. Hemorrhage may occur from mucous membranes. Occasionally there are on the skin small phlegmonous areas or petechiæ. The spleen is enlarged, the blood is dark, and remains fluid for a long time after death. Late in the disease the bacilli may be found in the blood.

The disease is found in operatives who have had to handle wool of infected animals imported from Russia or South America. Though malignant pustules may appear on the surface, yet in the majority of cases there is no external manifestation, but instead grave symptoms, such as involvement of the viscera, the lungs, bronchi and the brain, accompanied first by much pain in the chest and cough, and in the last by severe cerebral symptoms, among which convulsions are common. After death the capillaries in the brain are found stuffed with the bacilli.

In the pustular surface forms the mind may be unaffected to the last, and the patients fail to manifest any anxiety about their grave condition, but in the visceral forms, internal pains, both in the chest and in the back and limbs, and delirium are common.

Treatment.—The chief indications for treatment in this disease are of the nature of prophylaxis, which, of course, must vary according to the country or other circumstance connected with its prevalence. When it occurs among cattle or flocks of sheep the infected animals must at once be quarantined. In cases of malignant pustules appearing on the surface, the seat of inoculation should be cauterized with a hot iron, and every small pustule surrounding it should be injected with a small drop of carbolic acid, as in the treatment of boils. In the internal form of intestinal infection nothing can be done but stimulate the patient freely with alcohol and by large doses of quinin.

TUBERCULOSIS

More than anything else tuberculosis illustrates what an infective disease is. Instead of attacking one or a few animal species, as does typhoid fever, no warm-blooded creature is exempt from its invasion, and it even occurs among some of the cold-blooded

kinds, such as fishes and turtles. It prevails less among wild than among domesticated animals, but wild animals soon succumb to it if kept in captivity. Herbivora are more susceptible to it than carnivora, but it is not common in sheep or horses, or in dogs or cats. Among domesticated birds, such as fowls, turkeys, pigeons, and peacocks, it prevails in a special form, called avian tuberculosis, but tuberculosis is most virulent among cattle, for it is calculated that 20 per cent. of all cows become tuberculous. Among mankind, it is well termed "the great white plague," for it is estimated that it destroys from 1 in 7 to 1 in 9 of our race, but in civilized countries, both in Europe and America, the proportion is steadily declining, and in the United States it causes only one-eighth or one-ninth of the total deaths.

The *Bacillus tuberculosis* was first identified by Koch in 1882, but tuberculosis itself is the most ancient, historically known to us, of all infections except the Bubonic plague. Tuberculosis is accurately described by Hippocrates 2300 years ago, and is also referred to in Ebers' Egyptian papyrus, 1700 years before Hippocrates. We, therefore, have descriptions of it for 4000 years. Now, as the life period of a tubercle bacillus is only from twenty to thirty minutes, counting only the aged bacilli (half an hour old), this agent has passed through 7,420,000 generations without once changing its character. It is also claimed that it is mentioned in Babylonian inscriptions earlier than those in Egypt.

This bacillus grows only in the bodies of animals affected by the disease. It can be cultivated outside the body in specially prepared media, but it does not occur naturally in any particular soil or locality. It consists of slender rods varying in length between 1.5 and 3.6 mm. It has no spores, but in certain circumstances it may grow into much longer threads, which exhibit true branching. This shows that it is a higher form of life than ordinary bacteria, and that it is allied to those fungi called streptothrices.

This bacillus can be recognized by its taking on special stains, whose nature the reader can find in works on bacteriology. These bacilli contain the largest proportion of fat known among bacteria, and also a form of wax.

Miliary Tuberculosis.—The best situations in which to study the characters and properties of the tubercle bacillus are not in the gross lesions of the disease, but in those formations called miliary tubercles. These may be considered as the beginning of the changes caused by the tubercle bacillus itself. As such they may be recognized as minute translucent nodules, sometimes so small that they might almost be

called granules. They are composed at first of a roughly concentric mass of cells of elongated form, with long, oval nuclei, continuous with the cells of the surrounding tissue. Mingled with the cells, at the periphery of the nodule, are large multinuclear cells, called giant cells. The most significant fact, however, is that even in small miliary tubercles caseous changes at their center may already have begun. These caseous changes are the leading characteristics of tuberculous lesions.

Miliary tubercles may have their origin in a tuberculous gland which has made a connection with a vein external to it, so as to discharge its contents into the venous current of the blood. This event is a truly fatal catastrophe, leading to the formation of miliary tubercles, first in the pulmonary veins, and equally in the thoracic duct, and from thence proceeding to every organ of the body, producing general miliary tuberculosis. We will now see what the poisons of the tubercle bacillus can do. A general fever, not high in degree, but accompanied with great nutritive changes, follows, the general symptoms often resembling those of typhoid fever. In some cases, however, the lungs are most involved with symptoms of universal bronchitis. But the worst and most frequent changes are due to tuberculous meningitis, both of the base of the brain and along the spinal cord.

The varieties of tuberculosis are due to differences between the species of animals, thus the avian form occurs exclusively in birds. On the other hand, bovine tuberculosis is so closely allied to the human form that Koch's contention, that bovine tuberculosis cannot be transmitted to man, is undoubtedly erroneous, so that the eating of the flesh or drinking the milk of tuberculous cows is plainly dangerous. On the whole, therefore, it seems probable that all forms of tuberculosis, whether in man or in animals, are produced by the same organism, its modifications being due only to the different conditions found in different animals.

Immunity.—Being a chronic disease, it is, therefore, not self-limited, and hence it is doubtful if any artificially acquired immunity from it can be expected. Injections of various forms of tuberculin prepared from the dead bacilli were hoped, by some, to modify its course when given in fractional doses. At one time it was expected by Koch that his tuberculin might prove an antidote to the disease, but for this purpose it proved a signal failure, nor have any modifications of this treatment subsequently been really successful. Injections of tuberculin, however, are very useful for purposes of diagnosis, since when any body, whether human or animal, has become infected, a specific febrile reaction which lasts for a number of hours is caused, proving

the existence of tuberculosis in the body. Our only recourse against this disease has been to increase the vital resistance of the system.

The Role of the Tubercle Bacillus.—It becomes of great interest, therefore, to know how the tubercle bacillus itself is so resistant to any influences unfavorable to its growth. This may be partly explained by the peculiar properties of the bacillus itself in the changes which it occasions. In the first place, as just stated, this bacillus contains in its body more fat than any other micro-organism and, further, a peculiar form of wax. Both the fat and the wax have been shown to be poisonous, and this may account for that remarkable and specific property, which is characteristic of tuberculosis, of producing an alteration in its immediate neighborhood, to which the term "caseous" has been applied. The first effect of this caseous change is to obliterate all capillaries supplying the part. The tubercle bacilli, therefore, are at the beginning protected by these caseous deposits from being reached by any agent in the blood. In time, however, the bacilli themselves suffer from this deprivation of blood and degenerate. These deposits may at first be very small, but afterward may coalesce into considerable masses. Being a foreign body, it gives rise, in some cases, to an inflammatory action about the caseous deposit, which may fortunately limit the local spread of the disease by the formation of fibrous tissue. But this fibrosis is not general in its occurrence; instead of that, in some tissues, especially in the lungs, the inflammatory reaction allows fresh deposits of the bacilli to grow.

The essential poison of this bacillus is a peculiar nucleic acid, which may be called its true endotoxin. It contains from 9 to 11 per cent. of phosphorus. The most striking peculiarity of this toxin is its extraordinary resistance to heat and chemical decomposition, which explains the great difficulty of counteracting it.

Treatment.—We have no specific against tuberculosis either in the form of drugs or of any other kind of remedy. Another important fact is that tuberculosis is eminently a house disease, which is equivalent to saying that it is a disease of confinement within walls. As above stated, wild animals do not usually contract tuberculosis until they are kept in confinement, which renders them susceptible to it. But as all civilized people live in houses, this is the same as saying that a large proportion of them must be tuberculous, especially in the case of children. It is stated that in Vienna over 94 per cent. of children are infected. The prevalence of tuberculosis cannot be measured by those who present the clinical and physical symptoms of the disease, because, as Birch-Hirschfeld has shown, a very considerable percentage

of autopsies prove the existence of former tuberculous lesions of the lungs which have been healed. The real causes of such spontaneous healing are worthy of further study, since it is evident that such recovery must be due to the individual resistance of the system to the infection. The great problem of treatment in tuberculosis, therefore, is how to discover and promote the systemic resistance to this infection.

Hence, as we have said, our chief reliance in combating the ravages of this disease must be by combining all the measures which tend to increase the nutritive powers of each affected individual. First and foremost of these is *fresh air*, which is not easy to obtain in sufficient amount within doors. On that account, women, from their domestic habits, as a general rule, are more difficult to treat than men. But the reasons for fresh air being effective should be well understood. In the first place, direct sunlight kills the tubercle bacillus in seven minutes, and a free supply of fresh air greatly lessens its vitality.

Another important factor enters into the cause of pulmonary tuberculosis. Lung tissue, owing to the movements of respiration, never rests, and hence the difficulty of healing any injury to it. If a sore on a leg was rubbed up and down from 18 to 30 times a minute it could scarcely heal. But in a pulmonary sore we soon have another serious complication enter, and that is the invasion of damaged tissue by pyogenic cocci. In time the injury, effected by this disastrous alliance with pus-making organisms, may quite overshadow the original tubercular infection, rendering patients in the advanced stages of phthisis virtually cases of general pyemia. Now it happens that fresh air is as inimic to the pyogenic cocci producing their toxins as it is to the tubercle bacillus itself, and these two reasons should be explained to patients in order to incite them to be unremitting in their efforts to live an outdoor life. It is now the aim of physicians to treat pyemic patients, who have no tuberculosis, in wards erected on the roofs of hospitals, where the supply of fresh air is constant. The great success which has attended the treatment of consumption in various sanatoria is largely due to the arrangements made in those institutions for the patients to breathe fresh air, not only by day, but through the night. Muscular power also throughout living nature is proportional to the activity of respiration. Huxley calculated that if a man was proportionately as strong as a flea he could move the heavy building of Newgate Prison, the reason being that an insect breathes from every part of its body, while we breathe only through the local mechanism of the lungs. A free supply of oxygen, therefore, strengthens every muscular organ or tissue, such as the heart, the mus-

cular layer of the arteries, and the similar muscular supply of the bronchi. It also increases the tone of the stomach and of the intestines.

This explains the benefit to phthisical patients of residence in a dry atmosphere. In a dry atmosphere the interchange between the inhaled and the residual air in the lungs is much more active than when the outer atmosphere is so laden with moisture that there is but little difference between it and the air in the lungs. Other things being equal, phthisical patients do much better in high and dry regions, as in Colorado, than they do at the seaside.

Next to fresh air comes *feeding*. All patients with chronic febrile complaints need to assimilate more food than they would in health, in order to counteract the wasting caused by fever and by bacterial toxins. Therefore phthisical patients should be fed at least six times a day, but it should be remembered that food is food only when it is assimilated, and hence every effort should be made to maintain digestion at its highest efficiency. Injudicious overloading of the stomach may be as harmful as underfeeding, and so each patient's digestive capacity should be carefully noted.

Where practicable, the patients should not take their dinner alone, but with others, because it is well recognized that pleasant conversation is a great help to both relishing and digesting the meals, and, among other things, it would serve to divert their attention from their own malady. These meals should be varied from day to day, as, unlike other animals, man insists upon a variety in his diet. With reference to the articles of food, a patient with phthisis might with advantage eat like a carnivorous animal, and live largely on meat, particularly beef. After beef comes mutton. Poultry and fish are relatively of less value to him, except as they afford more variety. Milk should always take a leading place, because it can be easily taken between meals. It should be remembered, however, that milk, as such, is indigestible with adults. All races, therefore, who have to live exclusively on milk, such as the nomad Tartars and Bedouins, have discovered that the stomach must be spared the curdling of the milk, as this first step of digestion uses up a good deal of the pepsin of the stomach. They, therefore, invariably curdle the milk by fermentation, either by the yeast plant or with the Tartar "kefir." When so fermented, milk is the most perfect food in the world, as it is the only substance out of which every tissue can be made, illustrated at the beginning of life by all mammals. The only deficiency in milk is its small proportion of iron. In many cases milk is rendered more digestible by the addition

of alkalis, particularly lime-water, as this prevents the curd being too solid, like a piece of cheese, by making it flaky. The usual fault in prescribing lime-water is that too little of it is used. It should always be equal parts of lime-water and milk—a combination which will stay down in conditions of nausea when nothing else will. Eggs are also very valuable in the dietary, but in my opinion they are often prescribed in too great numbers, though here patients' peculiarities should be observed, for with some people eggs are quite indigestible. Butter is very advantageous, and should not only be spread on bread, but mixed with cereals or potatoes. Vegetables and fruits should be given freely, according to the patients' powers of assimilation. The patient should begin by taking a glass of milk, which may be either hot or cold according to taste, in the morning, half an hour before rising. No patient should attempt to dress without first taking some food. In many cases 2 or 4 teaspoonfuls of whisky in the milk may then be allowed. Breakfast at 7 to 8 A. M. should consist of crusty bread and plenty of butter with a digestible cereal, such as hominy, as this allows of considerable quantities of milk and cream being taken. This may be followed by two eggs, along with beefsteak or lamb chop, and with a good supply of potato, the best form of which is potato stewed in milk and cut up fine. If the patient is at all troubled with constipation, this meal should be begun with fruit, of which oranges are the best, or raw apples, if these are well borne. About 10 A. M. the first lunch of the patient may be taken, consisting of a glass of milk, with loaf gingerbread, rather than any other cake, the ginger in it counteracting the acid fermentation. Some may take a raw egg in the milk. Dinner at 1 o'clock should begin with soup, and then meat with potatoes and other vegetables, and should be the hearty meal of the day, according to rules already given. For dessert, puddings of a simple kind, but not pies. To this apple sauce or baked apples with cream may be added. The next meal should be a lunch at 4 o'clock. It should be remembered, however, that this is the beginning, in most cases, of the daily febrile rise, and hence had better be restricted to milk and bread and butter. The evening meal, from 6 to 7 o'clock, may be more hearty, and consists, for a change, of poultry or fish, of which the best form is shredded codfish in milk. On going to bed the patient should always take much the same meal as that of 10 A. M. But another important detail is that no patient should be allowed to remain wakeful through the night without some easily digestible food being at hand. Water may be taken freely.

Attention is not often sufficiently directed to the *state of the skin*.

In all febrile affections, but noticeably in phthisis, the first effect during prolonged fevers is to render the skin dry, but this dryness is sure to be followed by perspiration. In phthisis this perspiration is largely due to the toxins of the pyogenic cocci, and hence the exhausting night-sweats of this disease, which, besides being weakening, are frequently a cause of distress to the patient. Therefore I cannot but regard as a decided loss the discontinuance of the ancient practice of inunction, or anointing the body with oil. It should be remembered that the skin cannot absorb water as such, nor most other fluids; so that a person may sit for hours without any harm in a bath abounding with corrosive sublimate or other poisons. Yet everything oily can be made to pass through the skin by friction, and in the case of vegetable oils, like olive oil, may do so with decided advantage to the nutrition of the patient. Febrile processes, especially if accompanied by subcutaneous edema, lead to serious derangement of the cutaneous structures, as well as to the obliteration of the mouths of the sweat-glands. Hence the glossy appearance of the skin when the extremities are edematous, the scales of the epidermis becoming tightly superimposed one upon another. Oily inunctions counteract this, and so I am in the habit of ordering the body to be rubbed with oil in all dropsical conditions, particularly whenever I wish the skin to supplement the functions of the kidneys by proper perspiration. Night-sweats, therefore, are best treated, first, by sponging the surface with cold water, to be followed by a general inunction with oil, of which I find cocoanut oil to be the most serviceable. Half a dram of oil of cinnamon may be added to the pint of cocoanut oil, to give a grateful odor to the application. This inunction, performed generally once or twice a day, accompanied, of course, by active friction, greatly improves the nutrition of the skin and, by so much, the well being of the patient. As much as from $\frac{1}{2}$ to 1 oz. of cocoanut oil can thus be introduced into the system. But another fact is often strikingly illustrated by this procedure, namely, reduction of the temperature from 1 to 2 degrees.

Medicinal Treatment.—The primary indication in the treatment of pulmonary tuberculosis is to cut short the accompanying bronchitis. In proportion to the extent of the bronchitis will the healing powers of the system be interfered with. The tubercle-laden droplets are more or less widely dispersed through the bronchi during the deep inspiration which precedes the act of coughing. When the deposit is confined to the apex, counterirritation of the infraclavicular space is of great advantage. This may be secured by the application of several coatings of the collodion vesicant. The next indication, which is com-

mon to all forms of bronchitis, is to make the bronchial secretion as fluid as possible. This can be done much more effectively by the administration of oils than by prescribing the ammonium salts. On that account I regard it as a serious disadvantage that cod-liver oil has gone out of fashion to such an extent, due mainly to recent fads among the physicians of sanatoria. But there is another reason for the administration of cod-liver oil. Many years ago it was shown by Andral and Simon, and has been frequently confirmed since, that cod-liver oil increases the proportion of red corpuscles in the blood much more than iron or any other medicinal remedy. Iron, indeed, is contra-indicated in treatment of phthisis in all stages, however pronounced the anemia, due to the fact that iron is not assimilated in any febrile condition, but rather has a tendency to increase the fever. In fact, the prognosis in many cases of consumption is conditioned by the patient's ability to take cod-liver oil. Cod-liver oil should always be given shortly after eating, and, if at first a patient's stomach is deranged by it, it should be begun in teaspoonful doses, gradually increased to a tablespoonful. Its retention by the stomach is promoted by simultaneously taking an acid preparation of the pepsin, a common prescription of mine being 4 drams of lactic acid to 6 oz. of Fairchild's essence of pepsin, the dose being 2 teaspoonfuls with each dose of cod-liver oil. A good derivative preparation of cod-liver oil is called hydrolein, which is often better borne than cod-liver oil, a dose being a dessertspoonful. When a patient, as is so commonly the case, has an aggravation of his bronchitis, he should remain in bed two or three days, omit the cod-liver oil, and take my standard remedy for bronchitis, namely, the emulsion of linseed oil, the formula for which will be given in the article on Bronchitis.

The question often arises whether we have any medicinal remedy for tuberculosis, the answer to which is that undoubtedly the creosote carbonate or the guaiacol carbonate are efficacious for that purpose. The creosote carbonate emulsion will be mentioned in the article on the Treatment of Lobar Pneumonia. It ought to be administered in as large doses as the patient can conveniently take, beginning with a tablespoonful of the emulsion (equal to 15 gr. of the carbonate) an hour after meals and on getting to bed; to be increased afterward as freely as possible. The effect of this preparation, both on the bronchitis and on limiting the areas of pneumonic infiltration, is undoubted. Due to similar agents is the benefit derived from the resinous elements suspended in the air of pine forests, the primary effect of which is to diminish bronchitis, and, therefore, ought to be inhaled by the patients

as they would take fresh air. The list of other medicinal remedies for these patients is small. When there is profuse secretion the old prescription of Williams is of good service, which consisted of small doses (3 to 4 gr.) of potassium iodid, with 10 min. of dilute nitric acid.

Symptoms of Pulmonary Tuberculosis.—Fever.—A febrile temperature is a constant occurrence in the incipient stages, although, not being high, it is often unnoticed by the patient until it is demonstrated to him by use of the thermometer. Patients with a temperature of 102° F. may be so little discommoded by it that they continue to walk about. The patient, therefore, should never be without a clinical thermometer. In the early stages the temperature is more accurately registered in the rectum, but by consecutive observations it may, however, be pretty well judged when taken under the tongue. But the patient should not have recently taken either a hot or a cold drink, for it may be too low in one case, and too high in the other. The temperature is always raised by exercise. In phthisis, the morning temperature may be subnormal, but it rises in the afternoon about 3 o'clock. It is curious how often this fever may continue for days, at the beginning, without the patient being aware that there is anything wrong with him. But should a febrile temperature of 100° F. in the afternoon continue for many weeks, he should be carefully examined for pulmonary trouble; the only other causes of continuous fever being due to the presence of a hidden source of suppuration or to chronic rheumatism. There can be no doubt that this fever is produced in the early stages solely by the tubercle bacillus. Afterward, when the pyogenic cocci complicate the affection, the minimum and maximum temperature for the twenty-four hours vary greatly, in what may be called the hectic stage of the disease, ranging from 99° F. in the morning to 104° F. in the afternoon. Any degree of marked fever not due to complications indicates activity in the pulmonary lesions. Aspiration pneumonia not uncommonly follows hemoptysis, with a higher range of temperature for an uncertain number of days. In acute miliary tuberculosis the temperature is continuously high, with but slight morning remissions, so that it may be mistaken for typhoid fever. In fibroid tuberculosis, on the other hand, the temperature may be quite low.

The Pulse.—The state of the pulse should always be noted, for increased frequency is a constant symptom from beginning to end. At the very beginning the pulse may run from 90 to 100 beats, even though the patient is resting in bed. From the commencement the pulse is increased in frequency by slight causes which would not

affect it in health, such as mental excitement, or by slight physical exercise, or even a full meal, when the range may be between 90 to 120 beats, though this tachycardia is seldom noticed by the patient himself. This chronic frequency of the pulse must be due to the specific action of tuberculosis. In addition to the frequency of the pulse, the tension is low.

Next to the symptoms of the pulse we would rate *emaciation*. Emaciation, as we have stated, is not only loss of fat, but loss of bulk in every tissue of the body except one, that one being the nervous system. In advanced stages of phthisis this is particularly noticeable in the bones, the shafts of the long bones being very small and thin. The muscular tissues are equally affected. Young persons lose weight more rapidly than older ones. In the early stage the patient may note that he weighs at least 10 pounds less than his normal weight. Along with loss of weight there is apt to be loss of strength, which may be out of all proportion to the discoverable lesion. The patient may think that he has as much muscular strength as ever for a single act, but is, however, unable to sustain it for any length of time.

In appearance the patient may not at first show that he is anemic, but this mistake is natural, because the mucous membranes of the lips, for example, retain their red color. An inspection of his eyes, however, will show that the eyeball is too clearly seen through the conjunctiva and, therefore, has a glassy appearance. Neither the red cells nor the leukocytes are much affected at the beginning. Among digestive disorders, nausea is the earliest and most constant, being present in some cases before any other sign. Vomiting comes afterward, and is very common to occur after prolonged coughing, particularly from raising the accumulations in a cavity.

Cough, in the earliest stages of phthisis, may be one of the symptoms which the patient or his friends first notice. This cough at first is purely irritant and not expectorant, and is caused, as we have already explained, by the irritation of pleuritic adhesions about the apex. It is, therefore, of a dry, hacking character. After a time it becomes mixed with the sounds of an expectorant cough, especially on rising in the morning, when the patient may bring up small quantities of viscid mucus. He might be asked at this time whether he complains of slight rheumatic pains about his shoulders.

Examination of Chest.—It is now high time that the physician should make a careful physical examination of the chest by the methods of inspection, percussion, and auscultation. In some cases a dry cough, with fever and rapid pulse, progresses until the voice be-

comes changed or very hoarse, and finally suppressed. Inspection of the throat shows that it is universally injected, and in many cases very intolerant of the laryngoscopic mirror, the slightest touch of which on the palate causes vomiting. These symptoms are often caused by enlarged and infiltrated bronchial glands at the root of the lungs, which press upon the vagus or pneumogastric nerve. I have several times predicted that all these symptoms would, in due course, disappear, owing to the softening of the glands, causing the pressure on the vagus to lessen.

As the disease progresses more and more of the pulmonary tissues become consolidated, revealed by increased area of dulness on percussion, and commonly by increased vocal fremitus. On auscultation the inspiratory sound, which, at first, has the characteristics of harsh or peurile breathing, becomes louder and high pitched, while the expiration becomes prolonged, a very important sign, rarely found in health. This, in time, increases to true bronchial breathing, which is characterized by its high pitch and by its tubular quality, and by a pause between the end of inspiration, and the beginning of expiration, which sounds, in health, follow each other directly. Along with this, the voice is transmitted too clearly to the ear, and, if the consolidation is extensive, the voice sound is called bronchophony. At this time also it is well to listen to the sound produced by a whisper, as in counting. On inspection the infraclavicular space is depressed, and the movements of breathing are diminished, best noted by looking down from behind. As softening commences, bronchitis, in the affected area, is accompanied by râles. These often resemble the friction sounds produced by pleurisy, but can be distinguished from them by having the patient cough, which, by removing the bronchial secretions, changes the sound, while this does not occur in the continuous rubbing sound of pleurisy. When a cavity is formed the bronchial breathing is substituted by cavernous breathing, which is an exaggeration of bronchial breathing, with a greater interval between the end of inspiration and the beginning of expiration, and usually the expiration is of much lower pitch than the inspiration. If the cavity is superficial, the voice, whether ordinary or whispered, is transmitted to the ear so clearly that it is called pectoriloquy. By this time the expectoration has become very profuse and purulent. With further progress of the disease the sounds become very numerous and varied, cavernous near the cavity and bronchial in its neighborhood, and then with fine and coarse bronchial râles beyond. Meanwhile, the fever becomes more continuous, emaciation progresses, and now another complication may be

added, namely, tuberculous ulceration of the intestines, usually caused by the patient swallowing the infected sputum. Patients, therefore, should be told not to do that, though this may occur also during sleep. At this period night-sweats become very profuse, the larynx often becomes involved from infected expectoration, and aphthous sores then appear all through the mouth and throat, rendering swallowing painful, while the ulceration of the intestines leads to a loose but exhausting diarrhea.

I have often diminished the painful cough accompanying cavities by firmly strapping the ribs over the cavity with adhesive plaster, thereby diminishing the pull on the walls of the cavity by its extensive pleuritic adhesions.

Fibroid Phthisis.—A very important, if not essential, procedure for diagnosis in the early states of phthisis is an examination of the sputum, by the microscope, for the presence in it of tubercle bacilli. This should be done repeatedly, because the bacilli may not appear at first, but only after repeated examination. The best sputum to examine is that which is expectorated first, on rising in the morning. It should be noted, however, that it may be difficult to find the bacilli in the chronic form of phthisis, called fibroid phthisis, which condition may as well be described here.

This disease is chronic, lasting from ten to twenty or more years. Its chief symptoms are paroxysmal cough, most marked in the morning, with dyspnea on exertion. The expectoration may be profuse and purulent, and as the bronchi are frequently dilated in this condition, the retained secretion in them may be quite fetid, at other times the secretion is mucoid and contains small calcareous concretions. There is rarely fever, but the physical signs are very characteristic. The chest is sunken and the shoulder lower on the affected side. The heart is often drawn over and displaced, so that, if the left lung be involved, the area of the cardiac pulsation may be visible in the third, fourth, and fifth interspaces. Where the right lung is involved, I have known the heart-beat to be pronounced in the right armpit. Dropsy may also be present from failure of the right heart.

Tuberculous Laryngitis.—One of the most distressing complications, or accompaniments, of pulmonary phthisis is tuberculous laryngitis. The prognosis of phthisis is very unfavorable if tuberculous laryngitis sets in early. Usually it comes late, and is then due to the lodgment of the bacilli from the sputum in the mucous membrane of the larynx, and hence begins on the side of the larynx corresponding to the affected lung, forming shallow ulcers covered with a grayish

exudation, especially on the arytenoid. These ulcers may erode the true chords and finally destroy them. Even the epiglottis may be entirely destroyed.

Symptoms.—The first indication is slight huskiness of the voice, which, as the ulceration proceeds, causes, first, hoarseness and then complete aphonia. But the worst and most painful development is when the epiglottis is involved or possibly destroyed, when every attempt to take food brings on distressing paroxysms of suffocative cough.

Treatment.—The voice should not be used. Local applications (morphin, 1 part; finely powdered starch, 10 parts) every two or three hours often give relief.

The ulcers should be sprayed with a solution of tannic acid, 2 gr. to the ounce. A 4 per cent. solution of cocain may be used to enable a patient to suck milk from a vessel placed on the floor while his head hangs over the edge of the bed.

Tuberculous Lymphatic Glands.—For a long time scrofula and tuberculosis were considered as separate diseases. The term “scrofula” was then used to denote inflammation and chronic swelling of the lymphatic glands, especially about the neck. Since the discovery of the tubercle bacillus the term “scrofula” is no longer used, because the ubiquitous tubercle bacillus was found to be the cause of all the supposed scrofulous gland diseases, with the tendency, as everywhere else, to the specific caseous changes caused by tuberculosis. There can be no doubt, however, that the lymphatic glands form the first line of defense of the body against the infections. Nowhere is this so well demonstrated as in those cases where these glands are invaded by the tubercle bacillus, because almost invariably we find that the virulence of this bacillus is greatly lessened after it enters a lymphatic gland; in the majority of instances of tuberculous lymphatic glands, in the neck, for example, the disease does not become general, and is much milder in its course, so that most of these patients recover in a way that shows how truly this formidable infection is arrested. Experiments by R. Loving and Lingard are very conclusive, that the virulence of the tubercle bacillus is much lessened when it produces the characteristic changes in the lymphatic glands.

The starting-point in the process of this adenitis begins on the mucous membrane or the skin, thus ulcerations in the nose or chronic otitis or eczema of the scalp may be the beginning of inflammation of the lymphatic glands which lie nearest to the veins or lymphatics proceeding from those parts. Similarly, such lesions may be

the track for the infection by the tubercle bacillus, for often we find that so-called scrofulous glands have undoubtedly been preceded by chronic catarrh of the throat or nose, or like inflammations of the scalp.

Symptoms.—The first evidences of this infection in the neck, for example, are small enlargements of the lymphatic glands, which gradually grow to form painless discrete tumors, over which the skin at first is easily movable. These tumors may spontaneously subside without suppuration, while in other patients they progress until fluctuation shows that suppuration has taken place in the gland. Like suppuration elsewhere, the pus must be let out, for if it is left to burst externally it leaves an ugly scar, due to its slow process of healing. Sir James Paget prescribed a mode of preventing such a scar, which in after-life might greatly disfigure the neck, and be especially objectionable in women. His procedure was to make a minute opening through which he introduced two or three sterilized horse-hairs and left them there to drain the abscess, with the result that the skin was saved from ulceration. I have frequently adopted this procedure, with great success, in preventing all scars there in after-life. Though constitutional infection is not common, yet neglected scrofulous tumors may in time develop into pulmonary phthisis. In such cases the track of infection is by implication of the glands at the root of the lungs. A patient, therefore, with chronically enlarged glands in the neck should adopt the same measures of treatment prescribed for pulmonary tuberculosis.

Tuberculous Meningitis.—This sad affection occurs chiefly in children between the second and seventh years. When its nature is suspected a tubercular focus is to be looked for, either at the apices of the lungs or in some tubercular disease of bones and joints. But at other times no such discovery can be made, because the disease may begin in tuberculous peritonitis when its original seat may be in the mesenteric glands.

It has been supposed that drinking the milk of tuberculous cows or even of eating the beef of such animals may first infect the alimentary canal, and then extend to the bronchial glands, and, finally, to the membranes at the base of the brain.

In the majority of cases tubercular basal meningitis is the chief lesion found, occasionally with involvement of the cervical meninges as well.

The onset is usually gradual, marked by loss of appetite, emaciation, and irritability. One of the earliest and most significant symptoms

is an irregularity of the pulse. After a time febrile symptoms become more pronounced, though the temperature is rarely high.

But an ominous sign is the supervention of causeless vomiting. Soon afterward headache is complained of, coming on in paroxysms which cause the child to cry out. The pupils often at the beginning are contracted, but ere long definite symptoms show themselves by irregular contraction, and in the later stages they may be dilated. Disturbance of the muscles which move the eyeball, and which are innervated by the third and sixth nerves, causing the supervention of squint, are almost pathognomonic. Meantime the bowels are obstinately constipated, and, different from most other affections, the abdominal walls are retracted. Muscular symptoms then set in, consisting first of twitchings or of localized monoplegias, occasionally with retraction of the head. Ultimately, with the progress of the disease, effusion occurs in the ventricles, producing symptoms of brain pressure with coma.

This disease is often characterized by deceptive remissions, which, however, should never deceive the physician, for the prognosis of tubercular meningitis is always bad. The anatomic findings after death explain this fact, for the basal structures of the brain may be coated with a seropurulent exudate which follows the course of the chief brain arteries, but rarely extends to the superior cerebral convolutions.

One of the most trustworthy procedures for diagnosis is by examining the cerebrospinal fluid, obtained by lumbar puncture, which often settles the diagnosis at once, because in the turbid fluid so obtained the characteristic signs of tubercular meningitis, in distinction from other forms of meningitis, are found, including the actual presence of tubercle bacilli.

All *treatment* is practically unavailing in this malady, and our chief efforts should be to alleviate the symptoms by the administration of coal-tar derivatives, such as phenacetin, along with chloral. Iodids are often administered, but are unavailing.

Lupus, or Tuberculosis of the Skin.—Tuberculosis of the skin occurs most commonly in the form called lupus. The affected areas may be either circumscribed or diffuse. This infection of the skin always comes from without and has no connection with tuberculosis of the inner organs. The lesions occur either in the form of pale brownish or bluish non-vascularized nodules, sharply marked off from the adjacent normal skin, or as spreading hyperemic areas elevated above the surrounding surface, and showing their brown pigmentation only when the blood-vessels are emptied by pressure.

Their consequent ulcerations may appear on such exposed surfaces as the nose and cheeks. These ulcers are extraordinarily difficult to heal, for they reappear after having been seemingly cured. These ulcerations, besides being so obstinate, often cause unsightly scars which greatly disfigure the face. Their essentially tuberculous nature is demonstrated by finding the tubercle bacilli either *in situ* or in the discharges from the ulcers.

Treatment.—Being a tubercular disease, constitutional treatment the same as we would use for tuberculosis in general is always indicated, and for this purpose nothing can be better than a free and continuous use of cod-liver oil. To make the cod-liver oil more adaptable to the stomach, we should simultaneously administer acidulated pepsin, as we have mentioned previously, of 4 drams of lactic acid to 6 oz. of Fairchild's essence of pepsin; dose, 2 teaspoonfuls in water after meals with the cod-liver oil. Dr. T. McCall Anderson highly recommends phosphorus in this complaint, which may be given in 15-gr. doses of glycerophosphate of soda and of lime three times a day, just before eating or in the official syrup of the hypophosphites, the dose of which is 2 teaspoonfuls in water after meals.

The local treatment is by the use of more or less caustic applications, of which the best is Hebra's ointment, composed of arsenici albi 10 gr., cinnabaris factitiæ $\frac{1}{2}$ dram, unguenti rosati $\frac{1}{2}$ oz. This application only destroys the morbid structures and not the healthy skin, which is not even excoriated by it. Strips of linen of a finger's breadth, spread thickly with the paste, are first applied, a piece of wadding is then placed over them and kept firmly applied by means of strapping and a broad bandage. In twenty-four hours the dressing is renewed after first thoroughly cleansing the surface. After two or three applications the lupus nodules will be charred and of a brownish-black color. In a few hours after the removal of the paste, pain and swelling are gone, and in a few days eschars separate, when the ulcers speedily cicatrize, leaving very little disfigurement.

These facts show that the tubercle bacillus has great vitality, for, although not allied with any other infection and situated so superficially on the skin, it is yet by no means easily destroyed, requiring all of the powers of nutrition of the body to be called upon to resist its invasion, besides resisting the local application of strong caustics.

Tuberculosis of Bones.—Tuberculous disease of bones is a common affection, particularly in the young. We have treated elsewhere of tuberculous infection of the spinal column with consequent destruction of the vertebræ, and of the formation of abscesses, which as in

psoas abscess may point at a long distance from their original tuberculous focus in the bones. But tuberculosis may infect many other joints of the body, such as the hip-joint, with such destruction of the joint cavity that the bone is dislocated and may remain outside and above the acetabulum, causing shortening of the leg. The knee-joint may also be affected, accompanied with considerable effusion within the synovial capsules; this was formerly called white swelling of the knee and is often characterized by erosion of the cartilages and disease of all the bony structures of the joints. It is also not uncommon in the ankle- and wrist-joints, causing special deformities and fettering of the movements of those structures, which have to be treated according to their own indications.

One fact may be noted, which is, that tuberculous disease of bones does not often lead to general systemic tuberculosis, and but rarely leads to pulmonary phthisis.

LEPROSY

Among the chronic infectious diseases, leprosy is of great though of unknown antiquity. It is said that it is clearly described in Egyptian papyri thirty centuries before the Christian era. It is very fully described in the Bible, especially in the book of Leviticus, where the remarkable statement is made of its clinging to the walls of houses, so that it was enjoined to take the plaster down and burn it. Considering its affinity to tuberculosis, which also is very prone to settle upon walls, the ancient mention of this hygienic measure is interesting. Its epidemic prevalence is nowhere referred to, though in the Middle Ages it must have prevailed to a far greater extent than now, and yet at present it is found in every part of the world, in Russia, in Norway, in Iceland and in Hindustan, in China, and the Philippines. In America, it has undoubtedly been imported from Europe, and lately in California by the Chinese. In the United States its greatest prevalence has been in restricted areas of Louisiana. The discovery of the lepra bacillus by the Norwegian Hansen, of Bergen, might have been supposed to throw much light upon the nature and propagation of the disease, but instead these problems have been hardly advanced at all.

The organism belongs to the fission fungi, and is non-motile. Its length is half to three-quarters the diameter of a human red blood-corpuscle, and its breadth about one-fifth of its length. Spore-like bodies may be seen in the bacilli by high-power microscopes.

We are wholly uncertain about its modes of communication from person to person, although this must be accepted, because it is a

human disease and cannot be given to animals. Its bacilli are found in enormous numbers in leprous nodules, and equally so in such secretions as the saliva, and still more in the nasal passages. From their abundance it would seem as if infection by the lepra bacilli should be as common as in the case of tuberculosis. It is curious that the lepra bacilli and the tubercle bacilli are often mentioned together by writers as if they were allied forms, but it is very fortunate for mankind that they have no resemblance to each other in their most important features. The lepra bacilli can grow only in human bodies, and evidently do not easily lodge there, while tuberculosis, besides its ravages in the human species, attacks nearly every animal of the vertebrate series. To this day we are doubtful about its ways of dissemination. It is certainly not hereditary, and persons may be in close association for years with leprous patients without contracting the disease, nor has it any relation with either food or drink.

Symptoms.—Leprosy is always one disease, though it may assume different external manifestations. The first is called the smooth or anesthetic variety, the skin showing external white patches similar to leukoderma. A case which I saw in Syria would recall the language used about leprosy in the Bible, in which the skin is said to have been as white as snow. After various pains in the affected area it becomes quite anesthetic, so that pins may be pushed through the skin without pain. In this form the nervous trunks leading to the affected areas are thickened, enlarged, and beaded. The other or nodular form is usually preceded by a macular eruption, and in both forms bullæ which may be quite extensive may develop, soon to break and to leave deep ulcerations. The parts first affected are usually the ears, nose, and malar regions of the face, producing great disfiguration of the countenance, but the nodules may subsequently appear on the trunk, and then on the extremities. The most characteristic lesions, however, especially of the later stages of the disease, involve the fingers and toes, with such deep ulcerations resulting, that the phalanges drop off one by one. On mucous membranes the eruption is very similar in its course, and ulcerations may even involve the epiglottis, the larynx, and the vocal chords. It is peculiar, however, how extremely chronic may be the course of these local manifestations, lasting for years in many cases until the unfortunate sufferer dies from pure exhaustion.

Treatment.—There is no treatment for leprosy, though injections of Calmette's antivenene have been reported as actually curing the disease. I have seen, however, great improvement in a few cases in Syria, following the free doses of cod-liver oil.

RHEUMATIC FEVER

That rheumatic fever is the result of its own special infecting agent is now scarcely denied by anyone. It is equally plain that this agent has but little resemblance in its properties to that of any other infection. Thus it does not resemble any of the pyogenic organisms, whether streptococci or staphylococci, because the inflammation which it occasions, whether in the joints or in the tissues, is remarkably free from pus. This is not because the articular inflammations are not severe, for if we should see the same amount of heat, redness, and swelling occurring in a joint without any rheumatism, we would expect serious structural changes to be going on in the tissues of the joint. But a rheumatic joint inflammation, however severe, produces no serious organic changes, and this is further illustrated by the evanescent character of the inflammation itself, which may seem to be very great one day, while the next day the whole process almost subsides and is shifted to another joint, to go through the same stages there. In fact, apart from the heart and its appendages, permanent sequelæ of rheumatic inflammations are uncommon.

This statement also includes fettering of the joints, which is often very prolonged, by rheumatic inflammatory exudates of the sheaths of the tendons. Though this crippling may exist for years, yet if due to true rheumatism, the prognosis is always good for ultimate restoration of the normal movements by the persevering use of hot water douches, several times a day. On the other hand, a gouty arthritis, however mild its first onset, leaves a permanent deposit in the affected joint, besides characteristic deposits in other parts of the body, such as tophi in the external ear.

We might well expect, therefore, that the detection or identification of the causal agent of this disease would be difficult, and so it has proved, leading the majority of authorities to deny that it has been discovered. Numerous attempts have been made to identify this organism such as the bacillus of Achalme, but all in turn have failed of general acceptance. This, therefore, has led to a skepticism which, in my opinion, has gone too far. An organism first described by Wassermann in Germany, and Triboulet in France, has been claimed by Poynton and Paine and Ainslee Walker in England, to be so definitely demonstrated as the causative agent of this disease, that the English observers have given it the name of the *Diplococcus rheumaticus*. They isolated this organism from the blood itself and from the blood in the heart and from exudates in the pericardium, as well as the effusions in the joints, and finally from rheumatic nodules in the skin, and after

cultivation, injected them into rabbits, with the effect of producing multiple arthritis and both endocardial and pericardial inflammations, similar to those characteristic only of acute rheumatism, that is, without any pus formation or without any permanent changes in the tissues. Their results, however, have been denied by various experimenters, on the ground that this alleged *Diplococcus rheumaticus* was not found by them in the body of those suffering from rheumatic fever, either during life or after death, but these negative statements are not sufficient to disprove the positive result obtained by the above-mentioned observers. It is quite conceivable that such evanescent changes which characterize rheumatic inflammations may be caused by fluctuating developments of these specific micro-organisms.

Clinically, the only arthritic inflammation which may be mistaken for rheumatism is that produced by the gonococcus, and occasionally that which occurs in scarlatina, but the gonococcus not infrequently causes true ankylosis of the affected joints and scarlatinal arthritis very commonly gives rise to purulent collections, neither of which changes happen in true rheumatism.

Unlike other inflammatory infections, rheumatism leaves the lymphatic tissues and glands intact, but, as we might expect, serous membranes are often involved, and the synovial membranes of joints. In some cases the lung also becomes involved by extension both from the pleura and the pericardium, giving rise to true but secondary pneumonic processes in the affected lungs.

A striking confirmation of the specific infection of rheumatism being the organism named by Poynton and Paine, *Diplococcus rheumaticus*, is found in the phenomena accompanying the disease called chorea. Chorea is now generally admitted as resulting from the same agent which causes rheumatic fever. It is also accompanied very commonly with both endocarditis and pericarditis, while Poynton and Paine have plainly demonstrated the presence of the *Diplococcus rheumaticus* in the cerebrospinal fluid of patients affected with chorea.

Heart Affections.—Rheumatic fever would not be a grave disease, for its mortality is quite low, were it not for its occasioning serious affections of the heart and of its appendages. The commonest form of these cardiac affections is endocarditis, which in time involves the valves of the heart, particularly the mitral valves and less commonly the aortic. The pulmonary valves are but rarely affected. Owing to the high ratio of fibrin in the blood, the edges of the valves begin to show first roughening and then warty growths lining the

edges of these structures, giving rise to the sounds characteristic of these valvular changes. At first these changes do not affect very materially the circulatory apparatus, but in time they produce cicatricial contractions which may seriously derange the normal action of the valves either by making them incompetent or, in the case of the mitral valves, stenosed. Mitral stenosis is always a serious matter, as it tends to be progressive, as will be more fully described in the section on Diseases of the Heart. After the affection of the mitral, the aortic cusps are likewise involved, though usually only half as often as the mitral. Not infrequently both the mitral and the aortic valves are simultaneously implicated. The case of the aortic valvular incompetence, accompanied by regurgitation, is far more common than aortic obstruction.

Along with endocarditis, rheumatism, from its predilection for serous membranes, is prone to give rise to pericarditis, as will hereinafter be described.

When the endocarditis and pericarditis coexist we shall also inevitably have myocarditis. In this affection the muscular fibers of the heart undergo considerable fatty degeneration, and such general weakening that dilatation, particularly of the left chambers, takes place. It is uncommon to have any severe rheumatic affection of the heart occur without dilatation and enfeeblement of the heart's action, so as to be itself a not uncommon cause of death, especially in children.

Hyperpyrexia.—A fatal complication of rheumatic fever, but obscure in its origin, is the supervention of hyperpyrexia, in which the temperature rapidly rises to 108° or 110° F. It usually occurs in the first attack, about the middle of the second week, but cases have occurred in the second and in the third attack. The first symptoms are a subsidence of the articular pains, accompanied by rapid rising of the temperature. The serious nature of this complication should always be borne in mind when the thermometer reads above 104° F. As a rule, notwithstanding the high degree of fever the mind remains clear, but at other times the hyperpyrexia is accompanied by delirium or even convulsions. If the proper treatment is not at once adopted, the fever ends in stupor and in terminal coma. The treatment of these cases is the same as in the hyperpyrexia and coma of sunstroke, namely, the cold bath.

Treatment.—The cold bath is the only means known for dealing with this dangerous complication and should be administered at once, its temperature being about 65° F. The patient should be actively

rubbed while immersed as in the cold-bath treatment of typhoid fever, and the temperature carefully noted every few minutes, without the patient being removed from the bath. He should, however, be removed when the temperature has fallen 5 degrees, because the thermometer will continue to fall to normal or even below.

The presence of pneumonia or heart complications do not contraindicate these baths, nor does the occurrence of shivering until the effects of a dram of the compound spirits of sulphuric ether given in an ounce of camphor-water has first been tried. After the patient has recovered from the bath, his temperature must be carefully watched, for in the course of an hour or so the hyperpyrexia sets in again, so that cases have been reported in which twenty baths have been necessary to stop the recurrence of the hyperpyrexia before it finally gave in. In one case of my own the hyperpyrexia rapidly passed into coma, but recourse to the cold bath was the only thing which would restore the patient to his senses. After continuing these relapses for twenty-four hours he finally recovered, whereupon the joints began to be affected in the usual way.

Symptoms.—A precursor of a rheumatic infection occurs so frequently that it may rightly be pronounced as the first step in the process, namely, tonsillitis, especially if suppurative. For a number of years, I questioned the patients in my hospital wards, if previous to any joint involvement they had suffered from sore throat, and on careful inquiry found that this antecedent had occurred in fully 80 per cent. The rule was that the sore throat took the form of tonsillitis and would seem to give an incubation period of a full week before the joints began to be involved. In fully 50 per cent. of those cases, who had a history of more than one attack, sore throat preceded the development of rheumatism. This is a point of some practical importance, for I have often cured a chronic tendency to rheumatic inflammation by repeated douching of the throat.

Rheumatic fever is not ushered in, like other infections, by a rigor. The general antecedents are slight chilliness, anorexia, and a heavily coated tongue such as that always present in tonsillitis. After a short but variable period, a joint begins to be painful. Here it is well to note the contrasts which are present between the first attack of rheumatic arthritis and gouty arthritis, as these two joint inflammations are frequently confounded. In rheumatic arthritis, a number of joints in different parts of the body are involved with the first attack, while in gouty arthritis the rule is that only one joint is attacked, and that in the lower extremities, especially in the big toe.

It is not until the joints of the lower extremities, such as the toes and ankles, have been repeatedly attacked, it may be for years, that the knee follows suit. Once gout reaches the knee then it becomes polyarthritic, while rheumatism is polyarthritic with the very first attack. Years ago I drew attention to the difference between the most painful points in the affected joints of these two diseases, as hereinafter noted in my section on Gout. In rheumatism of the knee, for example, the pain is most elicited on pressure in the course of the tendons, such as above and below the patella, but in gout they are distinctly most pronounced by pressure on the condyles. Likewise in gouty fingers, pain is at once elicited by pressing the transverse diameter of the joint, while in rheumatism it is limited to the tendons above and below the articulation.

Other accompaniments of rheumatism, and of considerable diagnostic importance, are the subcutaneous nodules especially in children. They may vary in size from a small shot to a large pea and may develop on the finger and wrist or on other parts of the body, but notably on the scapula. When found, either in rheumatism or in chorea, they are a sure indication of rheumatic disease and are notably frequent when the mitral valve is involved, though their origin is not at all due to embolism. As a rule, they are not painful.

Various cutaneous eruptions are also associated with rheumatism, sometimes taking the form similar to scarlatinal erythema, at other times accompanied by urticaria, and purpuric infiltrations, going along with true arthritic affections, which go by the name of Schönlein's peliosis rheumatica. As all of these symptoms may develop in chorea, their relationship to rheumatism is undoubted.

Rheumatic fever rapidly raises the temperature to 102° or 104° F. and with but slight, if any morning remissions, and this fever may last with some fluctuation for four to six weeks. The old saying that an attack of acute rheumatism means six weeks in bed is not without justification.

One of the accompaniments of rheumatic fever is profuse sweating, which is very general and accompanied by a sour smell. This sweating may also show general sudamina or minute vesicles on the skin. It is by no means a trivial matter, because there can be no doubt that localized chilling of the skin over the thoracic viscera paves the way for internal inflammation of the pleura, pericardium, and endocardium, and, therefore, calls for special measures to be adopted.

Treatment of acute rheumatic fever will be both local and internal. There is nothing so characteristic of rheumatic inflammations

as the extreme hyperesthesia of the skin with pain on either movement or pressure. To relieve this, some authorities recommend fixation of the affected joints, by splints or even by starch bandages. These measures are quite ineffective, the best local application being to cover the whole inflamed area with cotton batting so as to exclude the air, while the pressure is much better prevented by the soft uniform protections so afforded. Anodyne liniments are not of much efficacy, with perhaps the exception of the belladonna liniment. Cotton batting is particularly called for to protect the heart and this should be continued throughout the whole course of the disease. On account of the accompanying perspiration, the patient should not lie between sheets, but always between blankets, and Dr. T. K. Chambers very properly recommends that in auscultation the stethoscope should be cautiously applied, without in any way exposing the surface of the skin. Every chill of the surface will be promptly followed by aggravation of the inflammatory process going on underneath that area of the skin.

If the pain of the joints continues the patient should take a draft containing 10 gr. of chloral, $\frac{1}{2}$ gr. of morphin, with 2 drops of dilute hydrocyanic acid. The medicinal treatment of rheumatic fever is of great importance, the danger of heart complications never being forgotten. Since the introduction of the salicylates, which have such a marked control over the pains, an unjustifiable abandonment of the old alkaline treatment, first introduced by Fuller, has occurred, with the result, according to my firm conviction, that cardiac complications are more common now than before. However striking may be the improvement in the pain and other accompaniments of rheumatic fever caused by the salicylates, these drugs do not diminish in any way the tendency to cardiac inflammations, while an adequate and early recourse to the alkaline treatment undoubtedly lessens the occurrence of both endocarditis and pericarditis. Instead of Fuller's treatment, which is somewhat complicated, bicarbonate of soda in $\frac{1}{4}$ -dram doses may be given along with 20 gr. of citrate of potash every two or three hours, until the urine becomes alkaline, whereupon the original doses may be taken less frequently. Should the urine, however, become acid again, the original frequency of the doses should be resumed.

As in other acute febrile diseases, it is well to begin the treatment with a calomel purge, consisting in an adult of 5 gr. of calomel and 35 gr. of compound jalap powder, to be repeated once or twice a week if the tongue becomes heavily coated. The treatment of acute rheumatism by the salicylates began with Dr. Maclagan, who first gave salicin,

with marked reduction of the fever and pain. This was soon followed by the general employment of the salicylates, particularly in the form of salicylate of soda. It is now common to prescribe for an adult 15 gr. of sodium salicylate every two or three hours, according to the severity of the symptoms. This often produces very annoying tinnitus and occasionally delirium. In some cases marked by enfeeblement of the heart, heavy doses of the sodium salt should be avoided, and should be accompanied by from 1 to 2 gr. of caffein citrate, and, still better, by the hypodermic injection of 7 gr. of camphor dissolved in 20 min. of sterilized olive or almond oil, as this is the most certain of all our cardiac stimulants.

Of all acute fevers, rheumatism causes the most rapid and pronounced anemia. This should never be treated with any preparation of iron, but toward the decline of the attack cod-liver oil should be perseveringly administered. As intimated above, prophylaxis of recurrent attacks should always be attempted, and this can only be done by douching the throat with from 1 to 2 gallons of hot normal saline, to which a dram of chlorate of potash and 5 drops of the oil of peppermint or wintergreen has been added to each gallon. This douche should be administered night and morning by means of a fountain bag suspended 5 feet above the patient's head. He should lean over a basin, keeping his mouth wide open, during the douche. The flow will then be directed from the nozzle over the base of the tongue until it impinges on the posterior wall of the pharynx, and then returns to the mouth by way of the tonsil, thus thoroughly cleansing this chief portal of the infection.

In chronic cases the skin should always be carefully protected, and undoubted efficacy against further chill is caused by the ancient practice of anointing the body, preferably with cocoanut oil to which oil of wintergreen ($\frac{1}{2}$ dram to the pint) has been added.

TONSILLITIS

The tonsils are a pair of organs situated in the vault of the pharynx. They are very vascular organs, as they are supplied by four different arterial branches. In their substance they have a number of recesses or crypts which may be involved in their inflammation, hence the exudates in them may extend on the surface so as to form by continued extension a pseudomembrane which may sometimes with difficulty be distinguished from a diphtheritic membrane, not easily identified except by cultural means. On that account it is always advisable when the exudate is of considerable extent to have this examined for

the determination whether it be diphtheritic or not in its nature, for that cannot be determined by its extent, since the exudation may be so small that it presents no distinction in appearance from that produced by other organisms. I once had a patient in whose throat there appeared a widely extending membrane covering over both tonsils and uvula, along with extension to neighboring parts. Upon examination, however, it proved bacteriologically to be of purely streptococcic nature. On the other hand, I had a case very closely resembling a diphtheritic exudation which extended over the whole throat anteriorly, but on bacteriologic examination proved to be caused by nothing but a streptococcus.

Acute tonsillitis may assume different conditions in different patients. One form is actively suppurative, and then most commonly is unilateral, beginning with sore throat and chilliness with general redness of the mucous surface and with so much tumefaction of the parts that it is difficult to open the mouth or to swallow. After twenty-four or thirty-six hours the swelling presents suppurative collections which may necessitate incision. Commonly, however, the abscess bursts spontaneously, followed by immediate relief of the symptoms. Meantime the tongue is heavily coated, and the symptoms are of an acute febrile infection. Very often after the abscess has burst in the course of seven or eight days acute rheumatism sets in, as we have remarked in our chapter on Rheumatic Fever.

Sometimes the exudate occurs in the submucosa, and then takes a chronic course which may last for more than two weeks before its nature is diagnosed, when it should be incised and treated as an ordinary acute, suppurative case.

Chronic tonsillitis is a very common affection involving extensive areas of the pharynx and often affecting the voice, particularly in the cases of public singers or speakers. This may be treated only by persistent douching of the throat, especially in that condition which has been termed "clergyman's sore throat." This form is never suppurative, but occasions prolonged affections, especially in those who are obliged to use their voices in public singing.

Treatment.—By far the best treatment is in the persevering use of the throat douche, as previously explained in our chapter on Rheumatic Fever. In acute tonsillitis the affection is often cut short by full doses of aconite in the form of tincture, 10 to 15 drops three times daily, or until the specific effects are felt in a sense of constriction of the throat or of tingling or numbness in the fingers.

In the mild cases the local application with a camel's-hair brush of the glycerite of borax may prove sufficient.

There is a specific connection between the circulation of the throat and the feet which should be treated by the application of dry (not moist) heat to the feet night and morning for about one-half hour at a time.

Gargles are of little use because the act of gargling does not extend down far enough in its effects to be very beneficial.

CHOREA

Clinical Course.—In the majority of cases chorea is a disease of childhood due to a leptomeningitis caused by the *Diplococcus rheumaticus*. Such a meningitis, being rheumatic, will not be exudative or purulent, but, owing to its seat, will be accompanied by special motor and cerebral symptoms. The cerebral symptoms show themselves in a state of mental irritability, with loss of control and inability to fix the attention, so that the child should be at once removed from school, for if he remains there the speech may become affected and the articulation mumbled and indistinct. In severe cases the acts of swallowing may become choreic, and then so impossible that the nutrition is gravely impaired. Ordinarily, however, the earliest symptoms are disorders of the seats of the highest cerebral activities, viz., awkwardness in the use of the fingers in the habitual acts. The lower extremities may also partake in the motor disturbance, and the gait becomes irregular or ataxic.

As might be expected in a cerebral trouble, it is often limited for a time to one side. But, like all affections caused by the *Diplococcus rheumaticus*, chorea should be anxiously watched for its tendency to produce endocarditis. As we have seen, rheumatic arthritis may be trivial in children, though the heart be gravely involved. And this is particularly true in chorea, for endocarditis occurs oftener in children with chorea than it does when a frank rheumatic arthritis is present. Many a case of serious and lifelong heart disease may be traced to an attack of chorea in childhood which had been overlooked because it was then so insidious.

The characteristic muscular movements which have given the name of St. Vitus' dance to the disease are just what we might expect from a diffuse irritation of the motor area in the brain cortex. Instead of localized twitching, still less of fibrillar movements, the whole muscle jerks from end to end.

These movements are not co-ordinated, nor can they be made so by the will. But the choreic movements by no means involve all muscular structures, those of the face and extremities being much more affected than those of the trunk. This is as might be expected, for the muscles of the face and of the hands, for example, are activated by the

highest cortical centers, while those of the neck and trunk are more under the sway of the spinal centers. The child begins with queer grimaces or, as commonly expressed, "makes faces," opening and shutting its eyes or lips or contracting its cheeks, with a special tendency to turn the face toward its shrugging shoulders, and the movements grow more pronounced as we go down, the elbows jerking more than the shoulders, while the hands and fingers are the worst of all. Corresponding to the irregular movements of the upper, are those of the lower, extremities. The thighs are not often affected, but below the knees choreic movements are so constant as to make the patients often stagger because the ankles and toes do not act together.

Like all true rheumatic affections, relapses are frequent, especially at the same time of year with the first attack, which commonly occurs in the early spring, rheumatic arthritis sometimes coinciding with chorea or following it. One effect, however, should be noted, and that is the tendency of rheumatism to produce anemia. This is a constant accompaniment of rheumatic fever in adults, but is no less marked in choreic children, so that some writers ascribe chorea to anemia, whereas it is the rheumatic poison which causes both the anemia and the chorea.

Rheumatic attacks are prone to vary in severity from time to time, and hence chorea does the same, particularly when its exciting causes coincide with the onset, such as fright.

We have dwelt on the rheumatic origin of chorea in children because of its important relations to treatment, as we shall see. But there are examples of choreic disorders which have nothing to do with rheumatism. One of the worst cases that I have ever seen was in a young soldier in our Civil War, which was caused by pure fright when he went into his first battle. He had to lie constantly on a mattress surrounded by other mattresses to prevent bodily injury from the incessant violent movements of his arms and legs.

Chorea in adults may be a very grave disease. It may occur in pregnancy in the third or fourth month or not until shortly after delivery. Its seriousness is then due to acute melancholia supervening, with signs of great prostration, from which the patient may die. The significance of the changes found postmortem in the brain is very uncertain.

Recently some important facts about the geographical distribution of rheumatic fever and of rheumatic arthritis have been demonstrated by Dr. J. T. Clark.¹ Dr. Clark has been a resident of the Malay States for a number of years, including the great seaport of Singapore, and he

¹Lancet, June 5, 1915.

maintains that neither rheumatic fever, chorea, nor rheumatic heart affections occur in the tropics. He quotes from the *Journal of Tropical Medicine* for 1911-12 the absence from tables of thousands of patients of either rheumatic fever or rheumatic arthritis.

This proves that the infective agent of rheumatic fever cannot prevail in localities where the heat is that ordinarily termed "tropical," but instead only in so-called "temperate" climates, and constitutes another evidence of the organic nature of the infection.

Treatment.—The list of remedies recommended for chorea is both long and varied, a fact which shows either that the disease often gets well spontaneously, or that it is difficult to cure. The first of these propositions is of common application in chorea, for the great majority of the patients recover, however they be treated. But there are cases which go on for months without appreciable change, though every reputed remedy has been given to them.

It is better, therefore, to aim at treating the disease from the first according to the chief indications rather than empirically. In children we ought to think of rheumatism first and of the danger of endocarditis. The heart should be examined at every visit. A systolic murmur at the base or at the apex will often be heard, and the character of the sound may vary from day to day.

So long, however, as the action of the heart is not appreciably quickened nor its rhythm disturbed, it may be hoped that no permanent cardiac mischief is impending.

But meanwhile what should be done? Prophylaxis is here of the first importance. Considering that the portal of infection of the rheumatic agent is the tonsils, the mouth should be thoroughly douched twice a day, as recommended for diphtheria and scarlet fever. This measure, of itself, will often suffice to forestall endocarditis. Meantime every precaution should be taken to prevent the child with choreic jerkings from catching cold by putting it in a cotton flannel bag tied securely about the neck, as before recommended, for nothing so disposes to internal inflammations as chill of the surface when wet with perspiration.

Some authors highly recommend Fowler's solution of arsenic in doses of 3 or 4 drops three times a day, but in my opinion with no better results than by the use of such restoratives as iron and cod-liver oil.

CEREBROSPINAL MENINGITIS

This terrible disease occurs both in a sporadic and in an epidemic form. It has not long been mentioned in history, and was first described by Vieussens, in Geneva, 1805, also independently by Daniel-

son and Mann, in Medford, Mass., during the same year. It is caused by the *Diplococcus intracellularis*, first described by Weichselbaum in 1887. This organism settles in the upper nasal passages, where it may be found in perfectly healthy persons, but it then can penetrate through the passages of the ethmoid bone and invade the meninges at the base of the brain, extending then upward to the cortex, and downward to the spinal cord, causing fibrinosis and purulent conditions as it travels.

It is due to its extensive exudates that it produces such serious results. Plastering, as it were, the structures at the base of the brain, it may involve one after the other of the cranial nerves, particularly the second, fifth, seventh, and eighth, causing optic atrophy, permanent deafness, paralysis of one or more of the eye muscles, and in many cases death. As it proceeds down it may cause acute suffering from implicating the muscles of the neck, and then of the whole spinal system, causing muscular rigidity and affecting both the sensory and motor nerves where they emerge from the canal.

The **clinical symptoms**, therefore, are very varied. In the majority of the acutely fatal cases death occurs in the first week, and in some epidemics within twenty-four hours. As a rule, the attack sets in suddenly, with violent chills, vomiting, headache, and grave constitutional depression. In many, painful contractions of the muscles of the neck, drawing the head backward, set in early, and may then proceed to make the whole spine rigid and arched either backward or to one side. Photophobia and sensitiveness to sounds may then develop. The pulse in children is rapid and small, but in adults is not uncommonly slow. The pains in the muscles become very severe and are often accompanied by tremors. Paralyzes are not so common, except of the eye muscles, when strabismus is an important diagnostic symptom.

Delirium often sets in early and, subsequently, coma. This coma may be quite prolonged, and is then not necessarily an unfavorable symptom, for the patient may lie unconscious from a serous effusion in the ventricles of the brain, which by its pressure may prevent the purulent exudations from occurring. I have more than once roused patients who were thus comatose for days by the application of a large blister to the neck.

In some severe cases the mind is never affected. One boy aged four years who developed many symptoms, including total deafness, the characteristic rash, and spinal rigidity, through seven weeks of agony preserved his mental faculties to the very end. In the acute stage there is frequently universal hyperesthesia, but more commonly

it is limited to the spinous processes. The temperature is irregular and variable, though frequently not rising above 102° F., but there may be exceptions. The cutaneous symptoms of the disease are quite diagnostic, the particular rash, which has given the name "spotted fever" to the disease, is always likewise variable, not occurring at all in some patients, and sometimes disappearing during a remission, to appear again during an exacerbation. The color of the eruption also varies, sometimes amounting to petechiæ and purple spots covering the whole skin. Leukocytosis is an early and constant feature, ranging from 25,000 to 40,000 per c.mm., its variations having no bearing upon the severity of the case, and persisting even in most protracted cases. The course of the disease cannot be predicted, because it is so variable; as Hirsch states, "it may range between a few hours and several months." Convalescence is extremely tedious, and may be interrupted by all sorts of complications and sequelæ.

Remissions in the fever are very irregular. When the disease becomes chronic, as it sometimes does, lasting for two months or more, most serious marasmus, characterized by a complicated series of symptoms, may occur. Pneumonia frequently arises, which may or may not closely resemble ordinary croupous pneumonia. We have already alluded to the actions of the optic nerve and of the still more common affections of the auditory nerve. These may cause both permanent blindness and permanent deafness, as in the case of the celebrated Helen Keller; but affections of the ear are more common than of the eye, and Von Ziemssen states that in the deaf and dumb institutions of Bamberg and Nuremberg the majority of the pupils have become deaf from epidemic cerebrospinal meningitis. Kernig's sign is one of special diagnostic value—when the thigh is flexed at right angles to the abdomen, the leg can be extended upon the thigh nearly in a straight line, but if meningitis be present, strong contractions of the flexors prevent the full extension of the leg on the thigh. Another important diagnostic symptom occurs from making a lumbar puncture and withdrawing the fluid from within the canal. If meningitis be present, this fluid enters the hypodermic syringe under markedly increased pressure, and when examined under the microscope shows abundant intracellular organisms or diplococci which can be readily distinguished from other organisms, such as the pneumococcus.

As before stated, this disease prevails as an epidemic in many regions both in Europe and in America. As a rule, country districts have been more affected than cities, but in New York in 1904 and 1905 there were 6755 cases and 3455 deaths. The epidemic outbreaks have occurred most frequently in the winter and spring. On the

other hand, it has been very prevalent in large barracks, particularly among young recruits. Everywhere, however, children are much more liable to the disease than adults, the disease appearing not at all directly contagious, and it is rare to have more than 1 or 2 cases in a house. On the other hand, meningitis carriers are persons who have the germ in their throats or noses, but who are themselves unaffected, which fact undoubtedly plays an important rôle in transmitting the disease.

Sporadic meningitis is found lingering in all the large cities of this country, and that it is the same as the epidemic form is proved by the demonstration of its specific—*Diplococcus intracellularis*.

Treatment.—Up to within a very recent period the treatment of this formidable disease was well-nigh hopeless. Symptomatically the severity of the symptoms might be allayed by the application of ice-bags to the head and to the spine, and in some cases I have found partial relief by the administration of dram doses of the fluidextract of ergot in adults, but the only measure which has proved of real service is the administration of the serum prepared by Dr. Simon Flexner, the use of which has been favorably reported in widely distributed epidemics both in America and in Europe.

ERYSIPELAS

Erysipelas occurs under three forms—medical, surgical, and puerperal. This affection is probably not contagious, as is maintained by some, because the streptococcus to which it is due requires a lesion to have taken place in the parts which it invades; hence it is like other streptococci usually found upon the skin or mucous membranes. Surgeons who most commonly observe this affection are prone to ignore the medical kind, but, clinically, there can be no doubt that this latter form may develop first in the system, then afterward appear upon the skin.

As to the *medical* form, the mode of its infection is obscure, but nevertheless undoubted. Thus I have predicted that a given case would within twenty-four hours show that it was erysipelas, while not a sign of the inflammation was yet discoverable anywhere on the surface. This prediction was based upon these clinical facts: first, the sudden occurrence of a violent chill, accompanied with the signs of an acute febrile infection. During this chill the patient's temperature rises very rapidly, sometimes reaching 107° F., the skin becomes burning hot, as it does in pneumonia, without, however, the least sign of the lungs being involved. After some twenty-four hours of these symptoms, a red spot develops upon the face, which soon afterward shows all

the characteristics of spreading erysipelas. The fever and constitutional symptoms, however, distinctly precede any cutaneous manifestation, and, therefore, cannot be due to any skin derangement. It is probable that all three forms are caused by the same organism which was first definitely identified by Fehleisen, who cultivated it outside the body on various media, and then produced its characteristic lesions by inoculation. Fehleisen's identification, however, has been called in question by other observers, who claim that it is no different from a *Streptococcus pyogenes*, but Fehleisen's coccus specifically differs from the *Streptococcus pyogenes*, in that when it is inoculated in healthy persons it causes no formation of pus. Moreover, the clinical course of this inflammation is quite different from any of the numerous pus-generating varieties of the streptococci.

The medical variety also differs from the surgical in running a shorter course, which ends by crisis, the temperature usually dropping to nearly normal on the fifth day. This affection was considered contagious first in England about 1850, and then in France, by Trousseau and Velpeau, and lastly in Germany, by Wernher in 1862 and Volkmann in 1869. But the disease cannot properly be called contagious when it does not spread from person to person by mere proximity, but rather by the infection of a wound or abrasion previously present. Streptococci that cause abscesses do not cause erysipelas even when their contents flow out through the cutaneous incision, whose edges they therefore necessarily bathe. The most frequent method of conveying the contagion is by the hands of nurses or of operators. This disease may begin first on the mucous membrane and then spread to the skin, or, vice versa, may begin in the skin and spread to the mucous membrane, its commonest seat being on the face or in the mouth. The virus clings closely to furniture, bedding, clothing, and the like. Some persons show a marked disposition to the disease, suffering from many attacks of it throughout their lives. Sometimes the same spot is attacked time after time.

Surgical erysipelas usually begins from some abrasion or wound upon the surface, and from thence spreads not by the blood-vessels, but in the lymphatic vessels of the corium. The specific nature of the erysipelatous streptococcus has been conclusively demonstrated by its artificial inoculation for the purpose of arresting the growth of lupus or even of some malignant diseases. In such cases the induced erysipelas may arrest for the time the growth of malignant tumors. While erysipelas itself does not usually cause suppuration, on the other hand, inoculation from suppurating wounds does not cause Feh-

leisen's erysipelas. After an erysipelatous inflammation the skin desquamates, and this infection is produced oftener by the scales from desquamation than by any other method of propagation.

The incubation period of erysipelas has been estimated at from three to seven days, but when introduced by inoculation it may appear in fifteen hours. It is best shown when it attacks the face and head, beginning as a sharply defined patch of redness, either on the cheeks or more commonly at the junction of the mucous membranes of the nose and skin. It may begin, however, near the margin of the hairy scalp. The affected skin becomes red, hot, swollen and shiny, with a feeling of burning pain. The patch then spreads by direct continuity to surrounding parts, always showing a sharply defined, raised red line. Where the disease spreads over loose tissues much serous effusion occurs into them, hence the eyelids become enormously swollen and the eyes closed. The ears are thickened and the features become quite unrecognizable. Blebs, more or less large, may also appear on the skin, which, when they burst, dry up, leaving adherent crusts. When the disease spreads to the scalp there is much headache, accompanied by local tenderness and swelling, but without marked redness. It is under the scalp that abscesses may form, not directly due to erysipelas, but to a mixed infection from the scalp, which may pass down the neck and then to the body in general. When it spreads over a joint, effusion takes place into its cavity, but in simple erysipelas it is never purulent. The most dangerous condition in erysipelas occurs when it attacks the mucous membrane of the throat. The throat is extremely painful, preventing deglutition, and causing much pain and difficulty in swallowing. Great edematous swelling also occurs, especially affecting the uvula, but the most perilous event is when erysipelas invades the larynx, as it causes there great edema of the epiglottis and arytenoid folds. This edema comes on very suddenly, and may terminate life unless the parts are quickly scarified, so as to reduce this dangerous swelling, but, notwithstanding this, it often necessitates recourse to tracheotomy to save life.

Following erysipelas the most important complication is diffuse cellulitis. This may lead to general pyemia, producing pleurisy, pericarditis, meningitis, or the disease may spread along the ear or Eustachian tube, leading to abscess of the middle ear with all its complications. Repeated attacks of erysipelas occurring season after season lead to much thickening of the skin and deformity.

Treatment.—Being under certain conditions contagious, no case of erysipelas should be admitted into a surgical ward, and it is equally imperative that such a case should never be allowed with puerperal

patients. If, however, the nurses and attendants are very careful to disinfect their hands, these dangers are much lessened. To the tense, inflamed skin vaselin should be freely applied, or else the lime-water liniment, with a dram of oil of cinnamon to the pint.

In mild cases little need be done except to keep the bowels free. The face should be covered with a lint mask, with apertures for the mouth, nose, and eyes, kept moist by a lotion of lead and opium, with 1 dram of oil of cinnamon to the pint. When the erysipelas extends to the scalp, nothing is so efficacious as an ice-bag. If the erysipelas begins in an extremity, and travels upward, a band of tincture of iodine should be made about the limb 3 inches above the advancing erysipelas. In the severer forms of this disease occurring in drunkards or debilitated subjects, the case should be treated on the stimulant plan, when alcohol may be freely used, while the patient's strength is sustained by copious drinks of milk and lime-water. The best stimulant for these conditions should be camphor, dissolved in sterilized olive or almond oil, and administered subcutaneously in doses of $\frac{1}{2}$ gram ($7\frac{1}{2}$ gr.) to 20 min. of the oil. Formerly the tincture of perchlorid of iron, in dram doses, was lauded as a specific in erysipelas, given every two or three hours, but it is a question if it is better than other methods of treatment.

Puerperal Form.—Fortunately, this form at present is well-nigh extinct in every civilized country, but when I first came to New York in the year 1862 it was justly considered one of the most dreaded scourges either of Europe or of America. In illustration I may say that while I was a student of medicine in the year 1858 I copied in my note-book an item from a medical journal that, in the maternity hospital in Vienna, Dr. Semmelweis had introduced the practice of all the attendants upon the hospital inmates of washing their hands in chlorin water, and then carefully cleansing their fingers with brushes, with the result that the mortality from puerperal fever in that institution had fallen from 57 to 12 per cent. No one then knew why this happened. Semmelweis himself did not live to reap his just reward, but died a persecuted and much maligned man. In that same maternity hospital in Vienna, though it has been much enlarged since Semmelweis' day, the mortality from puerperal fever, which was 28 per cent. of deaths from all cases in that institution in his time, has fallen off in the past year to $\frac{1}{4}$ of 1 per cent.

During the first year of my residence in New York I attended a discussion which occupied several consecutive sittings of the New York Academy of Medicine, on the "Nature and Treatment of Puerperal or Childbed Fever." That discussion was participated in by the most

distinguished physicians of this city, as well as by some eminent men from other places. Though the gentlemen who took part in it were both gifted and conscientious men, their remarks are melancholy enough reading to us, their successors, now, for not one of them had the faintest conception of the nature of the terrible malady they were talking about. One speaker's remarks, however, I particularly recall. His private practice took him to the homes of the rich oftener perhaps than did that of any other colleague. He particularly complained of the fearful epidemic of puerperal fever that winter, not only in his Bellevue Hospital wards, but also in the private families which he attended. If he now lived he probably would not have one case of puerperal fever in his family practice in many years, but what he did then was to go first to his dreadfully infected hospital wards, and then step into his carriage and drive as a real, though totally unconscious, messenger of death to a young mother lying in her richly furnished home.

This is only one illustration of the priceless gifts of modern medicine to the world. Since then science has discovered the relationship of micro-organisms to disease and death, which were formerly totally unknown.

PYEMIA

It may be well to refer here to infections of the blood itself with pyogenic organisms; leading to the condition termed "pyemia." The origins of this blood infection are very numerous, one illustration of which is from an extension of a suppurative process in the middle ear, through a small but very thin bony septum, which will infect a venous sinus lying over the partition. Pus organisms thus entering the sinus, pass down the jugular vein and then to the right side of the heart, often producing abscesses in the lungs, but also return to the left side of the heart and then are distributed to the liver and other viscera generally. Another condition is in cases of ulcerative endocarditis, giving rise to what may be called a general spray of minute emboli, lodging everywhere, and causing hemorrhages in the skin and extremities, and multiple abscesses in every part of the body. Chronic infections of septic endocarditis are often characterized by daily chills, followed by fever, which may be so periodic as closely to resemble malaria. The differential diagnosis from malaria in severe cases is easily made from the countenance of the patient, indicating a grave condition quite different from an attack of ague. On the other hand, the infecting organism may be the pneumococcus, which is specially prone to attack the joints. One of the most severe cases of suppuration in joints that I have met

was due to the *Staphylococcus pyogenes aureus*. On the other hand, some cases may be due to the *Bacillus coli*. The only help for these general blood infections we owe to the very recent advances in vaccine therapy.

DENGUE

Dengue usually occurs in a pandemic form, and is not exceeded, even by influenza, in its local prevalence. It is a disease almost exclusively confined to tropical or subtropical countries. In one Mediterranean city of about 100,000 inhabitants it suddenly developed, until it was maintained that no person escaped. It is, however, in no sense a fatal complaint, which is noteworthy, considering the severity of its clinical symptoms. It usually sets in without any premonitory symptoms, beginning with severe pains, in many cases, in every part of the body, but especially in the joints and muscles, the whole body becoming sore, and violent headaches both in the front and back. In some cases the pains are localized in the eyeballs. The fever is usually quite pronounced, and may reach 106° or 107° F., but out of proportion to the severity of these symptoms the patients are not much prostrated, being rather fettered in their movements of muscles and joints. The attack usually lasts a full week and is followed, on its subsidence, by symptoms of general debility. The pulse, even at the height of the disease, does not present any peculiarities other than those of frequency. Unlike other severe febrile affections, it has almost no complications. Its etiology as regards its causative agent is unknown. By some it has been ascribed to the bite of a mosquito, which is improbable, because mosquitoes are no more frequent either before or during the epidemic. Its treatment is purely symptomatic, as in other cases of temporary fever.

BERIBERI

This curious disease, which is both endemic and epidemic on the eastern coasts of the Asiatic continent, comes to our notice by cases occurring in our seaports. But it prevails among the Chinese in California. Personally, I have seen only 2 cases. The first, a girl of American parentage, who in early childhood contracted it while residing in Japan, with the result of arrest of her mental development for life. The second was a sailor who contracted it in Brazil. Besides paralysis of his limbs, he was the only case I have ever seen of complete paralysis of the diaphragm, so that the abdominal muscles largely protruded every time he took an inspiration.

The disease is essentially one of peripheral neuritis, caused by an unidentified toxin, and occurs in three principal clinical forms.

Clinical Course.—The first is characterized by wandering and ill-defined symptoms, the patient at the beginning appearing simply to have caught cold, accompanied by wandering pains in different parts of the body and by various paresthesias, such as numbness and tingling. These may be limited to the lower limbs, but ere long signs of muscular weakness come on, accompanied by tenderness to pressure of the muscles. These symptoms may temporarily disappear, to recur, however, especially in the advent of warm weather, and such signs may come and go for many years.

In the second form, weakness and paralysis of the muscular system is the most pronounced. This muscular paralysis shows the same character of tenderness to pressure of the implicated muscles, but, besides this, signs of muscular atrophy appear in different parts of the body, occasionally even in the muscles of the face. Ere long the patient may be unable to walk or to raise the arms.

The third form is the dropsical, characterized by anasarca or subcutaneous or even subserous effusions, the water accumulating in both pleuræ.

Meantime, in each of these forms, but particularly in the dropsical variety, signs of heart weakness develop, due to the invasion of the myocardium and accompanied by palpitation and dyspnea. In one of these attacks the patient may suddenly die. Occasionally the symptoms of heart failure are so pronounced from the beginning that some writers speak of a fourth or pernicious form, so characterized by signs of heart failure that the patients die within twenty-four hours, but most of these cases survive for several days.

As to the etiology, there is wide diversity of opinion even among those who have had the most experience in its study.

Treatment.—The most striking facts about the prevention and treatment of this disease, are found in the effect of changes in diet. Thus, Takagi, the surgeon-general of the Japanese Navy, completely banished this disease from his ships, in which it had been ruinously prevalent, by ordering the diet to be composed of much more nitrogenous food than that to which the sailors had been previously accustomed. On the other hand, Java physicians have had similar success in prescribing that the coolies, among whom beriberi was very prevalent, should take only rice which had not been shelled of its pericarp. It would seem, therefore, from these facts that a suitable dietary is more important than anything else, both for preventing and for curing this curious complaint.

This, however, leaves unexplained the outbreak of this disease in

certain isolated and widely separated localities, such as the Richmond Asylum, in Dublin, Ireland, and the State Insane Asylum, at Tuscaloosa, Alabama, in both of which cases it is stated there was much overcrowding in the building. These isolated outbreaks of this disease have, therefore, afforded some support to those authorities who claim that beriberi is a truly infectious disease; but what the infecting agent is has never been demonstrated.

Besides the adoption of changes of diet, local measures for the effects of the disease, such as muscular atrophy, may be adopted, on the same line as in other similar cases, such as massage of the wasted muscles and applications of electricity. Baelz recommends, in early cases, a free use of the salicylates (15 or 20 gr.) four or five times a day.

PELLAGRA

This severe and curious disease was first named pellagra (smarting skin) by Frapolli, in the beginning of the eighteenth century.

It has prevailed so extensively where maize is an article of diet that it has been ascribed to fungus growth upon moldy maize. But the area of maize consumption is now known to be wider than that of pellagra, and pellagra is found where maize is at least not an ordinary diet. Recent researches, while they have added many facts to our previous knowledge of the disease, have left its specific origin and nature still obscure. An illustration of this statement is that Dr. L. W. Sambon, at a meeting of the British Medical Association in 1905, suggested that pellagra was probably protozoal in origin, and that the protozoan was communicated by sand flies, just as sleeping sickness is by the African tsetse. This view was also endorsed by Sir Patrick Manson.

Pellagra prevails especially in Italy, in the South of France, in Spain, Roumania and Corfu, also in Egypt and India. Of late years it has appeared in the United States, particularly in North Carolina, South Carolina, Maryland, Georgia, Alabama, and Texas.

Symptoms.—As a rule, it is a chronic disease, beginning in the spring and subsiding in the summer, but returning with greater severity the following spring, and so on for subsequent years, until the patient succumbs. An acute form, however, has been reported as occurring epidemically in the Mt. Vernon hospital for colored insane, in Alabama, with the high mortality of 64 per cent. Pellagra begins, in adults, with headache, dizziness, ringing in the ears, a burning sensation of the skin, especially in the hands and feet, and diarrhea; at the same time a red rash appears on the skin, resembling erysipelas,

the red spots being tense and painful, especially when exposed to the sun. When these spots disappear toward the close of the summer, the skin remains rough and dry. With each successive year the results of the attacks become more pronounced, by extensive changes of the skin, until it resembles that of a mummy. Meanwhile, other symptoms develop, such as red and dry tongue, a burning feeling in the mouth, pain on swallowing, and diarrhea. Ere long serious symptoms follow, due to implication of the nervous system, shown first by ptosis of the eyelids, dilatation of the pupil, and other signs which are explained by changes revealed at postmortem examination, consisting of degeneration in the spinal cord of the posterior columns of Goll and of Burdach, similar to those found in tabes. Meanwhile, pigmentary changes proceed in the skin which resemble those of Addison's disease. Atrophy of the muscles follow, and finally death from exhaustion.

The only **treatment** which has been at all successful has been that reported by Babes, following his administration of atoxyl, which shows that this disease is of protozoal origin, similar to the sleeping sickness of Africa.

It is probable that urotropin would be of service, 10 gr. four times a day, with a similar dose of benzoate of soda.

ACTINOMYCOSIS

This is a rare disease, and is due to an infection, not by bacterium, but by a fungus called *Streptothrix actinomyces*. I have had 1 case in my practice, that of a farmer, who came for a serious bronchitis involving his right lung. The expectoration was profuse and somewhat fetid. The patient maintained that he was sure it was caused from inhalation of musty dust while he was winnowing oats in his barn. The diagnosis of this complaint can only be made by the discovery of the fungus itself. Many of the cases begin in the lungs, and form abscesses which may infect the whole system, including, according to some reports, even the brain. Some of these abscesses may occur in bone, while others may invade such organs as the liver and spleen, when, as is often the case, the mycelium first develops in the mouth, and it may attack the jaw, forming a tumor closely resembling a sarcoma. The patients, when the affection becomes at all generalized, die with the symptoms of chronic pyemia.

Treatment.—The only remedy which is reported to have been of any service is potassium iodid in doses of from 40 to 60 gr. a day.

RELAPSING FEVER

This is a specific infectious disease whose agent was first identified by Obermeier in 1873 as due to a spirochete. It is, however, an ancient disease, as it is very probably described by Hippocrates, and then and now so common among badly fed people that it long ago received the name of "famine fever," prevailing especially during war in besieged cities.

In 1869 it prevailed as an epidemic in New York and Philadelphia, but has died out completely since, as it has in Europe also, owing doubtless to improvement in the food supply. We may note here that famines were of frequent occurrence in every country of Europe during the Middle Ages, and were doubtless due to the great difficulties of transportation of food-stuffs from place to place. Nowadays no such deficiency can be threatened anywhere without the telegraph quickly announcing it and the railroad as promptly relieving it. This formerly relapsing fever is now well-nigh extinct.

Relapsing fever is not a fatal disease. Murchison quoted the deaths as only 4 per cent., and generally only from intercurrent complications.

Symptoms.—The incubation may be very short, or from five to seven days after exposure. The invasion is sudden, with chills, fever, and great pain in the back and in the limbs. The temperature rises rapidly and may reach 104° F. on the first day. The pulse is frequent, ranging from 110 to 130. Swelling of the spleen appears early and jaundice is not infrequent. The blood becomes charged with the spirochete, along with some leukocytosis. After lasting for five or six days the fever is said to end in a crisis, the temperature falling to normal or even below it; the convalescence seems rapid, so that the patient may be up and about in a few days, but the relapse will occur usually by the fourteenth day, sometimes with rigors and with all the former symptoms again. A second crisis occurs from the twentieth to the twenty-third day, and again the patient recovers rapidly. As a rule, the relapse is shorter than the original attack. A second and a third may occur, and there are instances on record of even a fourth. In some epidemics there are no relapses after the first attack, or there may be two or more relapses, which leave the patient much exhausted. In some epidemics a troublesome ophthalmia occurs, and intercurrent complications, such as hematuria or pneumonia.

Treatment is symptomatic, because we have no special remedy for the complaint.

MALTA OR MEDITERRANEAN FEVER

This peculiar endemic fever was proved by Bruce, in 1886, to be due to a specific micro-organism present in the blood, which he named "*Micrococcus melitensis*," which caused great trouble to the British Government for many years, from the number of soldiers and sailors who yearly had to be invalided home from the garrisons of Malta and Gibraltar, affecting not only the soldiers, but the sailors of the British fleet. But though Bruce identified the micro-organism, its origin remained for eighteen years unknown, until the British Government requested a commission, appointed by the Royal Society, to investigate it. This commission established the fact, in 1904-05, that this organism first infects goats and then passes into their milk. As goats' milk was the only milk which the soldiers or sailors consumed, the government substituted for it condensed milk brought from England, with the result that whereas in 1905 there were 750 cases, in 1907 there were only 7 cases among soldiers, but none in the fleet.

There could scarcely be a better illustration than this of the value of bacteriologic examination in dealing with an epidemic; a fact also illustrated in the stamping out of such awful destroyers of the human race as the bubonic plague and Asiatic cholera. Besides Malta and Gibraltar, the cities along the Mediterranean shore, especially Naples, also reported the existence of this disease, which extended to India and China.

The mortality in this infection is not high, usually less than 7 per cent., but its course is very characteristic. The period of incubation is from six to ten days; the fever is very irregularly remittent, so that it has often been mistaken for malarial infection. The fever may last for from two to three weeks, followed by complete remission for two days, after which it sets in as bad as ever, and may continue for six months, leaving the patient anemic and exhausted. During its course rheumatoid pains may occur and the joints become inflamed and swollen; as the remissions occur, profuse sweats are common.

Treatment.—Quinin has been used in large doses for this infection, but without any avail. The disease has to run its course, so that it is possible that phenacetin given in 15-gr. doses four times a day may mitigate the symptoms. Prophylaxis is, after all, the chief indication, for the infection can be wholly prevented by abandoning the use of infected milk.

CHAPTER IV

INFECTIONS COMMUNICABLE BY INOCULATION

MALARIA

IN no class of infections has the progress of medical science been so signal as in the discovery of the mode of entrance of infections by inoculation. A good illustration of this is shown in the first infection which we shall treat, under that erroneous term "malaria." From the earliest times this cause of disease and death in the human race was supposed to be due to simple inhalation of poisoned air, hence its name, *mal-aria*. Another common term, equally mistaken, was that of miasmatic disease, the conception being that it was caused by an emanation from the soil, especially of marshy and low localities, of a disease-producing vapor or gas. This was a natural inference from the prevalence of malarial infections in marshy localities everywhere except in the Arctic regions. The good effects of drainage of wet soils seemed thus to be easily explained. This mistake led to further erroneous suppositions that the water from soggy localities was, when swallowed, often the cause of severe fever. This, however, did not explain the marked periodicity of the attacks of ague. Nevertheless, the other apparent accompaniments of malarial affections seemed too plain to dispossess the minds of both the profession and of the laity of the wide prevalence of malaria in all its forms. It was not until our own day that this venerable error was dissipated. The first step was taken in 1880 by Laveran, a French army surgeon in Algiers, who discovered that the blood of malarial patients was full of an organism which attacked the red blood-corpuscles. This discovery remained for years unexplained as to the mode of entrance of the parasite into the blood and body, and it was not explained until the remarkable researches of two American army surgeons, Drs. Kilbourne and Theobald Smith, who were deputed by the United States Government to investigate the cause of the Texas cattle fever. This fever affected cattle coming from Texas, but only when they passed through a certain district in the state of Kansas. Drs. Kilbourne and Smith investigated the soil, water, and air of the Kansas district without discovering any explanation of the infection, but they finally found that there

was a tick living in the grass of the infected region which crept up the hoofs of the cattle and bit them just above the fetlock. Examining these ticks, they found about their mouths swarms of protozoa which were exactly similar to the protozoa which multiply so amazingly in the blood of the cattle. They then took specimens of these ticks and carried them to Texas, and had them bite cattle there, with the immediate result of infecting them just the same as they were in Kansas. The same kind of ticks transported to Illinois and Ohio, where this fever was wholly unknown, produced the identical disease there, of a protozoan called *Piroplasma bigeminum*. This discovery gave the hint of parasites invading the blood-corpuscles by the bites of insects. Profiting by the hint suggested by the Texas cattle fever, a number of Italian observers demonstrated that a particular variety of mosquito, called the anopheles, abounding in the Pontine marshes of Italy, could infect persons with malarial fever, though the insects themselves were transported to localities where malaria was unknown, including London itself. This led to very extensive researches by Marchifava, Celli, Councilman, and others, who confirmed and further extended our knowledge of the different varieties of mosquitoes. The general result was that this infection is due to the presence in the blood of an animal parasite, which enters and grows in the red corpuscle, and whose different species produce the varying clinical forms of the malarial fevers. Thus the tertian ague is caused by a different parasite from the quartan, and both of these are different from the estivo-autumnal parasite, which latter is much the most difficult form to treat. The particular forms of these parasites can be readily distinguished from one another under the microscope, and, in fact, at present the diagnosis of malaria is not established until repeated examinations of the blood show their presence in the red corpuscles.

We may say here that the mosquito was supposed to be the cause of malaria fully 2000 years ago by Varro and Columella, but this hypothesis, though maintained by numerous subsequent writers, remained unverified until Bignami, the Italian, in 1896 demonstrated that the infection of malaria is caused by one only out of 125 species of mosquito, the *Anopheles claviger*. This was further confirmed by Ross in 1897, who demonstrated that the hematozoa of birds were transported by a certain species of mosquito. The genus anopheles contains 50 species, all of which can transmit the disease. Specimens of this mosquito were taken to a convent on the Apennines, now turned into a prison, and allowed to bite the prisoners there, with the result that they immediately contracted malaria. Some of the same mosquitoes

were sent to London, where two young medical men allowed their hands to be bitten by them, with the result that they forthwith contracted the disease in London, where it was wholly unknown, and it is now generally admitted that it is only this genus of mosquito which spreads malarial infection. Of course, such a specific animal parasite can neither be a gas, a bad air, nor a miasm. The fact, however, remains that this mosquito can give malaria only by sucking the blood of a person infected by these organisms; but which came first, the mosquito or the infected human being, is like determining the old question, whether the egg came first or the hen which laid it. The practical deduction, however, is that to rid a district of malaria we must first either exterminate the insects which are its carriers, or quarantine the patient whose blood abounds with this protozoan.

Biologically, it is incorrect to call the parasite of malaria a plasmodium, since its true position is among the sporozoa. These, when sucked by the mosquito from the infected patient, undergo specific changes in the intestine of the mosquito, and then, at certain stages, they leave the intestine and collect about the insect's proboscis, so as to be ready thereby to infect the blood in the way that the Texas ticks infected the blood of the cattle. The life cycle of these parasites in the blood is now very well determined, so that we can say that the paroxysms of the chill and the onset of the fever correspond in time with the formation and maturation of the parasitic spores; this process taking in one species thirty-six hours, and in another seventy-two hours, while in the estivo-autumnal varieties it may be quotidian, tertian, quartan, or hebdominal in its intervals. The infection of the blood by these parasites is always a serious matter. Since the introduction of quinin, when given early, especially at the beginning, it was erroneously supposed that ague might be cured by this drug in less than a week, but it may be safely said that no case of ague can be cured by drugs in less than six weeks, while in other forms, especially the estivo-autumnal, the blood may never be freed from them for many years, if at all. I have a patient now who has been under my treatment for twelve years, and, in spite of a great variety of remedies employed, is liable to relapses with appearances of the parasites every few weeks.

Symptoms.—Malarial disease being due to an invasion of the blood by an animal parasite, presents a great many contrasts with true bacterial infections. The first thing to note is that these animal parasites are of three distinct species, which can be readily distinguished from one another by their appearance under the microscope. The first is that of the tertian parasite, and the second is that of the quartan, but

the most dangerous is the so-called estivo-autumnal form, which derives its name from its prevalence in temperate climates during the summer and autumn months, but in the tropics it prevails the year round. Its presence can be easily recognized by its crescentic form, and, as such, should be carefully studied by the student. While the various serious developments which occur in malarial disease may be caused by any one of its specific forms, yet much the commonest and most intractable species is the estivo-autumnal, which shows a great variety in its clinical symptoms, an example of which occurred to me at the beginning of my medical experience in the cases of three young Englishmen who were prostrated by an attack of fever while visiting the shores of the Dead Sea in Palestine. The extraordinary experience with this fever there, was that no patient survived the third attack, while the majority succumbed from the second attack. The symptoms were those of heart failure with great dyspnea or congestion of the lungs, while the whole body was bedewed with a cold perspiration. The attacks were definitely tertian. I saw them after they had passed through the first attack, when my medical instructor prevented a return on the second day, during the remission, by administering 30 gr. of quinin at two-hour intervals until they had taken 90 gr. It was not until 90 gr. had been swallowed that the first signs of ringing in the ears appeared, but they were then safe, though they had to continue large doses of quinin for several weeks. In other places the brunt of the pernicious attack is spent upon the abdominal organs, characterized by excruciating pains at the epigastrium, with vomiting and diarrhea, so much so that they have often been treated for Asiatic cholera. In every instance, however, the correct diagnosis can be made only by microscopic examination of the blood. Not uncommonly, symptoms of dysentery of a severe variety set in, which will be wholly unamenable to treatment until the connection with malaria is discovered. As a rule, the temperature is high, from 103° F. upward, but in these attacks the temperature is a very uncertain guide, some of the worst forms presenting a low temperature. One of the worst forms is when the brain is involved, causing rapid development of coma; the capillaries of the brain itself as well as those of the meninges being crowded with parasites. I have known, however, of an attack of coma being suddenly caused in a day laborer while digging a ditch, who was brought to the hospital not only comatose, but with highly albuminous urine filled with casts. The character of his pulse, however, satisfied me that he had no chronic kidney complaint, and, therefore, that his coma could not be uremic. An

examination of his blood showed it charged with the ordinary tertian parasites, and quinin soon restored him from his coma and relieved his kidneys as well.

In the tropics, however, with cases of the estivo-autumnal type, comatose symptoms are of very serious import, the onset in some cases being gradual, while in others profound stupor develops very rapidly, death occurring between the third and sixth day. A common form is that of a more or less chronic mixed infection with the different species of the malarial parasite, leading to a long-continued fever which is marked by irregular remissions. In this form the liver suffers especially, becoming enlarged and tender, the stomach becomes very irritable, with copious vomiting of bile-stained fluids. This is ordinarily known as the bilious remittent fever, and is easily confounded with typhoid fever. The study of the temperature curve will show that it does not correspond to that of true typhoid, and here again the discovery of the malarial organism in the blood settles the diagnosis. On one occasion at the Roosevelt Hospital I had 3 cases of malarial fever, and typhoid fever occurring simultaneously. In 2 of these the malarial organisms disappeared altogether until the typhoid fever had run its course, when they reappeared during the convalescence.

As we have remarked before, the infection with the malarial parasite is always a serious matter, however easily it may seem at first to be controlled by quinin. Though the patient may continue to feel well, he is not so, because when some physical or mental strain occurs three or six months afterward the old malarial paroxysm develops as severe as ever. This shows that the ordinary defensive powers of the system are able to hold the infection in check, but no more, for let any extra call be made upon the vital powers and the whole disease reappears. An explanation of this is furnished by a study of the urine, which for months after an infection shows that at a certain hour the excretion of urea is doubled or even trebled. This increase, corresponding to what would have been a febrile malarial paroxysm, proves that the treatment of malaria is virtually that of a very chronic disease, subject to periodic exacerbations which are curiously hebdominal or weekly in their occurrence, relapses commonly happening on the seventh, fourteenth, twenty-first, or twenty-eighth days. Other cases, again, have a seasonal character, coming at intervals of six months or a year after the original attack.

Treatment.—The treatment of malaria calls naturally for varying measures. Thus it will differ according to locality. In the same places where malaria is not particularly rife, the treatment

which will suffice to control the development of the disease will call for smaller doses than in localities which are strongly infected. Thus, in malarious districts found along the banks of the Thames in England a dose of 12 gr. of quinin in the course of twenty-four hours will be sufficient, while in most places in the United States the dose has to vary from 18 to 30 gr. a day. My own practice has been to commence the treatment with a calomel purge, and then not to administer the quinin alone, but always in combination with an equal amount of powdered ginger. It is a significant fact that spices are throughout the vegetable kingdom formed to protect the inner bark, but especially the seeds of the plant, for the purpose of preventing the seeds from the attacks of vegetable fungi or of insects, and all spices are virtually varieties of carbolic acid, and hence can be made to promote the action of quinin. It is on this account that that extraordinary farrago called Warburg's tincture, which in its original formula contains 76 ingredients, including powdered snake-skins, constitutes such an efficient substitute for quinin itself. My usual practice is to put up equal parts of powdered ginger and quinin in 6-gr. capsules, and then to administer two of these capsules twice, three times, or four times a day; in other words, giving 12, 18, or 24 gr. of quinin in the first twenty-four hours. In some cases I have added powdered capsicum in the proportion of 1 gr. to 4 gr. of quinin. Where this prescription is given for the first time it may act upon the bowels, but usually not after the first day. If the malarial attack be an ordinary tertian, the administration of the capsules should be begun on the day of the remission: two in the forenoon, two in the afternoon, and two in the evening, with a fourth dose on the morning of the attack, given two hours before its expected onset. If this medication suffices to prevent the occurrence of the paroxysm, the morning dose on the well day may be omitted, while the others are continued as before for a whole week. After this four capsules should be taken every day for six weeks, the number being increased to six capsules on the seventh, fourteenth, twenty-first, and twenty-eighth days.

In quartan attacks the same treatment should be pursued, the only difference being that a dose of these capsules should be given early in the morning, and repeated at two-hour intervals for three doses, the last dose being an hour before the expected paroxysm, which usually occurs in the afternoon. It should be remembered that both for the tertian and quartan varieties the infection is not got rid of in less than three months, if not longer. Prophylactic doses, therefore, amounting to from 6 to 9 gr. of quinin daily, should be continued, with

the addition of 3 gr. more on the morning of the seventh, fourteenth, and twenty-first days, the only modification being that one dose may be omitted if it produces the characteristic ringing of the ears. The reasons for this prolonged treatment after a malarial infection are that for weeks after the first developed attack a great increase in the excretion of urea, occasionally amounting to three or four times the excretion of urea at any other hour, occurs at the time of the original paroxysm, showing the infection is still working in the system, though it may not be enough to produce an attack of chills and fever.

These measures, however, do not suffice for that most serious of all malarial infection due to the estivo-autumnal parasite, which frequently resists the heaviest doses of either quinin or Warburg's tincture. Treatment by arsenic also frequently proves equally efficacious. Arsenic when administered against malaria acts on a wholly different principle from quinin. It does not break the paroxysms at once; rather, its operation is gradual, and plainly operates through its being a constitutional poison to the malarial parasite; its good effects appearing only gradually, somewhat in the same fashion as mercury acts against the spirochete of syphilis. The dosage of arsenic is regulated altogether by its effects upon the stomach, for, like other constitutional remedies, it fails as soon as it produces symptoms of its own, such as epigastric uneasiness or pain. The arsenic may be administered either in its liquid form of Fowler's solution, or in a combination with quinin, as the arsenite of soda, in doses of from $\frac{1}{20}$ to $\frac{1}{16}$ gr.

A good illustration of the inefficacy of all measures previously recommended in the treatment of serious infection by the estivo-autumnal parasite was furnished at the Roosevelt Hospital in the cases of 61 American soldiers returning from the campaign in Cuba during the Spanish-American War of 1898. The duration of their illness before coming to the Roosevelt Hospital on August 17th had ranged from twenty to forty days. In all instances they had been treated first with quinin, and in a large proportion this had been supplemented by free dosing with Warburg's tincture and with arsenic.

Subsequent to September 1st and extending to October 20th, 39 additional cases were admitted, making 100 in all, besides a group of mixed malarial and typhoid cases. Of this list, 63 were actively febrile, the temperature ranging from 103° to 107° F. Of these, 40 per cent. had chills, with the usual succession of symptoms, but with true intermissions in only 10 per cent. The chills were irregular rather than periodic in the remaining 30 per cent. They seemed in some cases

to be double tertian, and some double quartan, but it was difficult to settle this fact conclusively in any of them, as the paroxysms of rigors were very irregular. The remaining 60 per cent. of the febrile cases had no chills, and the course of the fever in them was very variable, the temperature range rising and falling with such irregularity that the curves on the charts were in this respect characteristic of the affection, and in marked contrast to those of typhoid fever.

The malaria organisms were found in 90 per cent. of all the cases; in some, however, not until after repeated examinations. The commonest forms were crescentic. Some patients showed relatively large crescents, and some small. These crescents were often very numerous, occasionally markedly so, in groups of patients who had been admitted together, as if they had been equally exposed to the same infection. Besides the crescents, there were many actively motile extracellular bodies visible, which were very small and round in contour. Masses of free pigment were often seen in the field as well as in the white corpuscles. Only one definite separate flagellum was detected, but more might have been found but for press of time.

In their clinical features the most pronounced effect on the patients was anemia, with emaciation, often extreme. The impoverishment of the blood seemed to be progressive, for it continued in many of the febrile cases much as it does in patients with pernicious anemia, without febrile paroxysms. The anemia also appeared to be quite independent of the enlargement of the liver or spleen. The liver was noted as enlarged in not more than 5 per cent. The spleen was enlarged in about 50 per cent.

In the majority of the patients when they were running an actively febrile temperature there was no delirium, but instead a characteristic taciturnity, all questions being answered correctly, but slowly and in monosyllables, the patients remaining wholly apathetic and indifferent to their surroundings. It was upon this particular symptom that the effect of a special medicinal treatment, to be mentioned presently, was most marked.

After admission to the hospital some 65 of these patients were treated for fourteen days by careful feeding and nursing, in hopes that the change from camp and transport conditions would of itself be beneficial, and, along with this, quinin in doses of from 40 to 60 gr. a day were administered, or Warburg's tincture in $\frac{1}{4}$ -oz. doses three times a day, while others were treated with arsenic either alone or added to the other drugs. The general results had been unsatisfactory. In some cases the quinin held the temperature for a few days, but only

to be followed by relapses. Its best results were in the small number of patients who showed periodic remissions. Warburg's tincture seemed to be more successful than quinin, but arsenic, though pushed to the production of digestive disturbances, appeared to be of very doubtful effect. Cold baths were used with 6 patients with high temperatures, but they did not bear them well. The course of the fever not being modified thereby, the baths were abandoned.

The report of this experience of two weeks in the management of these patients led me to try a modification of treatment as follows: 15 gr. of quinin with 15 gr. of powdered ginger were administered twice a day—once in the forenoon and once in the afternoon—with $\frac{1}{2}$ oz. of the camphorated tincture of opium, and a like dose of the latter without quinin at 10 P. M. An ounce and one-half of paregoric, equal to 3 to $3\frac{1}{2}$ gr. of opium, was thus taken daily. All the patients with whom this was first tried, 47 in number, were actively febrile, 84 per cent. of them severely so. In order, however, to test comparatively the effect of this medication, 14 febrile cases, of whom 65 per cent. were severe, were treated with Warburg's tincture alone as controls.

The results were as follows: In 22, or 46 per cent., of the number who took paregoric the result was an immediate break in the fever, that is, the temperature fell to normal within twenty-four hours, nor did it rise again afterward. This effect was the more impressive because in every instance they had been unavailingly treated for an average period of ten days previously without reducing the fever. The treatment was then continued from seven to fourteen days, when the men were discharged. Under this head of reduction of temperature in twenty-four hours were 5 patients who had been treated exclusively by large doses of Warburg's tincture without its affecting the temperature. Of the remaining 25 out of the 47 there were 10 patients, or about 21 per cent., in whom it took from thirty-six to forty-eight hours to reduce the temperature to normal. Of the remaining 15, there were 3 in whom this treatment failed to control the temperature. One of these had a severe chronic colitis, to which his moderate but long-continued fever seemed to be mainly due.

No relapse was recorded in any patient who took the paregoric treatment after the temperature was once reduced to normal. In 1 case it took three days before the temperature became normal; previously the patient had not been affected by Warburg's tincture. In 5 cases, or 10.6 per cent., the paregoric treatment could not be continued on account of its causing nausea. These patients were then treated by the above doses of quinin and ginger alone, with a relatively

slow recovery, except in 1 case, which soon yielded to a third dose added to the usual prescription.

The experience of the British Government in India upon a very large scale shows that the administration of opium is one of the most certain remedies against malaria in the tropics, and this is now pretty well settled, as Sir William Roberts demonstrated, by the presence in opium of an alkaloid misnamed narcotin, and which should be called anarcotin, owing to the entire absence in it of narcotic properties. The proportion of the two alkaloids in Smyrna opium are morphin 8 per cent., anarcotin 2 per cent., while in Bengal or India opium the proportion is morphin 4 per cent. and anarcotin 6 per cent. I chose paregoric on account of its containing camphor and other stimulants which are not to be omitted in the treatment of a serious malarial infection.

In the neighborhood of New York I have also met with cases in which the usual treatment with quinin was quite inefficacious, but which yielded to doses of anarcotin not exceeding 12 gr. a day. Some eminent authors speak as if quinin were a specific for every case of malarial infection, and that a practitioner who failed to cure by quinin should be read out of the profession. In my own opinion the authors of such statements only show that their knowledge of malaria is limited.

YELLOW FEVER

This disease of American origin has never prevailed in Asia, but in the regions which it invades it is historically one of the most fatal of epidemics. In 1790 it destroyed one-tenth of the inhabitants of Philadelphia. My own medical life began with yellow fever, when I was appointed physician to the New York Quarantine in the year 1858, and my experience then fully illustrated why there was such an uncertainty as to the nature of the disease. In that year the U. S. Frigate *Susquehanna* entered New York harbor with a severe epidemic of yellow fever on board. All the officers and crew were landed at the quarantine, and the sick taken to the quarantine hospital. The frigate was then fumigated with the best of all such agents, wood smoke, because wood smoke contains finely divided particles of fresh charcoal with acetic and carbolic acids. Two men from the shore, neither of whom were immune, were left in charge of the vessel, where they remained for two weeks. One afternoon a thunder-shower caused these men to go below deck, and they broke into the gun room, which had not been reached by the smoke, and where the liquors were stored. In seventy hours thereafter both men were taken with yellow fever.

Meantime, not one of the sick gave yellow fever to either physicians or nurses of the hospital, and such has been the history of the hospital for fifty years. But, however numerous the cases which were admitted with yellow fever, no hospital attendant ever contracted the disease. On the other hand, I declined the lucrative office of deputy health officer, because every such officer had contracted yellow fever, though he had nothing to do with the patients, but simply boarded the ships to inspect them. These facts seemed to point conclusively to yellow fever clinging to inanimate objects, like the hold of a ship. It was naturally supposed, therefore, that everything in a ship might become a carrier of the disease, such as articles of clothing, either of wools, or especially of silk, and I declined presents of cigars from captains of Havana ships from fear of the silk ribbons about the bunches. All articles of clothing, therefore, that were valuable were wheeled into iron ovens, where they were subjected to a degree of dry heat supposed to destroy any infection. Other articles were collected into a large iron scow, which every night was towed down into the lower bay and its contents burned. Meantime, the clothing of the sick was furnished by the hospital. So far, experience demonstrated that yellow fever was not in the least contagious any more than ague. But there were other facts about the infection which were of special interest, the first being that it was a delicate organism which could not stand the frost, and infected ships were even sent north where they would encounter cold weather. Another fact was that the disease clung to seaports or rivers and did not ascend any mountain-ranges, but beyond this nothing was certain.

The germ theory of disease was not yet even broached, the word "bacterium" was not heard of, all of which illustrates how impossible it was then to know anything about infectious diseases except their clinical manifestations. We now know that yellow fever was due alone to a kind of mosquito, called the "stegomyia." This mosquito has its own habits of life, which explain why it was for so long unsuspected of harm. In the first place it is very domestic, and is not found in the street nor out of doors, but breeds wherever it can find little receptacles of water, such as tin cans, basins, and pails. It was by dealing directly with these domestic utensils that Colonel Gorgas destroyed these mosquitoes in Havana, and changed that city from being the source of danger to every American city during the summer months, because Havana, under his administration became free from any case of yellow fever for a whole year, a feat which Colonel Gorgas has repeated in the Panama Zone.

Like malaria, yellow fever can be transmitted from person to person by injection of the infected blood, but, wholly unlike malaria, its virus can pass through a porcelain filter and then transmit the disease as actively as ever, which shows that this specific and active form of life is ultramicroscopic. This feature is not without its bearing upon the question of what life itself is.

The facts connected with the nature of this disease were not established without a great deal of patient and widespread labor, marked by the unselfish devotion of medical men, some of whom sacrificed their lives in this dangerous investigation. First in time came the origin and rise of the great science of bacteriology, and hence it was natural that one form of bacterium after another was supposed by different observers to be the cause of yellow fever. In this search Surgeon-general Sternburg, of the United States Army, bore a distinguished part, and it was largely due to him that the supposed connection with bacteria was disproved. Moreover, the search for some protozoan or animal parasite similar to the protozoan that infests us in malaria, and also cattle in different diseases was equally unsuccessful. There can be little doubt that the yellow fever agent is a protozoan, though it shows one feature usually restricted to bacterial diseases, namely, that one attack, as a rule, confers permanent immunity against the second attack.

The mosquito after it has bitten an infected person cannot transmit the disease for twelve days, but after that may be infective for fifty-seven days or as long as it lives. The incubation period of human beings after infection is from forty-one hours to five days and seventeen hours.

Symptoms.—In the majority no premonitory symptoms may occur, or may be confined to headaches or pains throughout the body. The onset is frequently with rigors, the temperature rapidly rising to 102° or above 106° F., the face generally suffused, the conjunctivæ being injected, and there may be considerable photophobia with severe backache and pains in the limbs. The urine is diminished in quantity, but not albuminous. An early symptom is distress, often with pain at the epigastrium. These symptoms continue during the second day, to which may be added a yellowish tinge to the eyeballs. Vomiting may set in at this stage, but consists only of the contents of the stomach. By the third day the symptoms may vary according to the severity of the attack. In bad cases the temperature begins to fall, even below normal, to be succeeded by the very ominous development of black vomit. This at first consists of black specks in the ejecta, but after-

ward its color fully justifies the term "black vomit." Severe pains may take place in the abdomen, and then by the fifth day general jaundice is the dominant feature. The temperature at this time may rise, again to be followed by an irregular fall. Along with the cramps in the abdomen and the black vomit, tarry discharges may follow from the bowels. By this time the signs of general prostration become extreme, and may be accompanied by hiccup, delirium, convulsions, coma, and death. In all severe cases a characteristic fall in the pulse compared with the temperature takes place, the pulse falling to 70, 60, or 50 per minute. In this disease, as in other infections, there is a great variation between different individuals in the severity of the attacks, some even being but slightly ill, while others in the same house rapidly succumb to black vomit and its attendant symptoms. These milder cases are a little more likely to experience a second attack than those who recover from the severer forms of development.

Changes in the heart are not specific, and are similar to those occurring in bad intoxications by other agents. The stomach presents more or less hyperemia of the mucosa with catarrhal swelling, and contains the material which ejected during life is known as the black vomit. There is often general glandular enlargement, in which the cervical and mesenteric groups are most involved. The liver is usually of a pale-yellow or brownish-yellow color, with its cells in various states of fatty degeneration. The kidneys always show traces of diffuse nephritis.

Treatment.—As might be expected, treatment is of very little avail in this specific disease and should be simply symptomatic. At the beginning a large dose of castor oil of from 1 to 2 oz. may be tried, and after this rectal irrigation with normal saline of from 1 to 2 gallons at a time. The fever, however, should be combated with a cold bath, as in the treatment of typhoid fever. When the heart begins to fail, the only remedy is by hypodermic injections of 7 gr. of camphor in sterilized almond or olive oil, to be repeated every two or three hours. A proper antiserum treatment for yellow fever has not yet been found.

Due to the progress of medical science, this once formidable epidemic disease is now well-nigh extinct.

TETANUS

The pathology of tetanus was the subject of my first publication in the year 1861. I had then lost a horse belonging to the New York Quarantine, who died from tetanus, and on looking up the literature I found that the greater number of authors at that time pronounced tetanus to be due to the puncture or bruising of a peripheral nerve. What

causes a nerve so injured to produce tetanus a leading medical authority, Watson, then said was the mystery. On inquiry, I found that there was a whole district on Staten Island where tetanus was endemic, so that horses and calves which were to be gelded had to be sent away from that district, because otherwise they would inevitably succumb to tetanus. Further inquiries showed that a similar region where tetanus was endemic was on the shores of Long Island Sound, and that in both cases, namely, Staten Island and Connecticut, the land was manured by fish called "moss-bunkers." These facts at once demonstrated the improbability of injury of peripheral nerves occurring epidemically in a restricted area, and made it much more likely that tetanus was due to a poison in the blood similar in its effects to that of strychnin. The analogies between poisoning by strychnin and tetanus are numerous. In both, the chief clinical feature is tetanic spasm of the muscles, accompanied by excessive reflex excitability of the surface nerves. An animal poisoned by strychnin remains free from the convulsions so long as it is not touched, but the lightest application to the skin or even a breath of air throws it into convulsions. Similarly, a patient with tetanus must be kept absolutely quiet, for both a draft of air or even a sudden light will bring on the general spasms. The differences between strychnin- and tetanus-poisoning are sufficient to be clearly demonstrated, as they have been in medicolegal trials. Strychnin does not produce lock-jaw, and the muscles relax after the spasm, while in tetanus the tonic contractions persist, marked by exacerbations of the spasm from time to time.

The actual demonstration that tetanus is caused by a specific bacterium was really made by Nicolaier in 1885, but it was not isolated from the pus or discharges from the wound until accomplished by Kitasato in 1889. Knud Faber, in 1890, was the first to demonstrate that all the symptoms of tetanus could be produced by injection of its toxin into the blood without any of its bacteria. This led finally to the demonstration that the tetanus bacilli are limited to the seat in the body where they were first inoculated, and that they are not to be found in any other situation. This is probably the only example of the kind in pathology. In other diseases the bacteria which cause them are disseminated everywhere, but in tetanus the causes of the infection always remain local, and they are its absorbed toxins and not the bacilli themselves which produce the fatal result. The practical importance of this is insisted upon by Moscovitz, who advises that the seat of the inoculation of the bacilli should be cut out in order to prevent the formation of any more toxins there. "*Bacillus tetani*" is a slender rod

which may grow into long threads, one end of which is often swollen and occupied by a spore. The spores are very resistant to a great variety of disinfectants, such as carbolic acid, corrosive sublimate, and heat, and these are the facts which demonstrate the dangers due to the wide distribution in nature of this deadly agent, which has been found to penetrate fully 6 feet beneath the surface of the ground. The tetanus bacillus is especially abundant in garden earth, particularly where horse manure has been used, for it is said that this bacillus exists normally in the intestines of the horse. Hence it is much more apt to infect through injuries of the foot, such as by treading upon a nail, than in injuries of the upper extremities. Still it has been known to follow upon infection of mere scratches of the skin, because it can survive drying for at least a number of days upon wood splinters.

Like other bacteria, tetanus requires a period of incubation after its entrance before it manifests any of its symptoms. An important rule is that the shorter the period of incubation, the worse the prognosis. The period of incubation also is much shorter in warm climates. In temperate climates the rule is from one to twenty-two days. I had a valued acquaintance who was a sea captain, and who, while loading guano from off the coast of Peru, had his hand bruised by a cask as it was being swung on board. He died from tetanus in less than twenty-four hours.

The chief effect of the tetanus toxin is that it reaches the spinal cord, not by the blood nor even by the lymph, but proceeds directly along the substance of the nerve, and is claimed by Tiberti to be propagated along the axis-cylinder, due to the chemical affinity of nerve-cells for the poison.

Great hopes were entertained on the announcement that an antitoxin for tetanus had been discovered by Kitasato and Behring, but, unfortunately, tetanus antitoxin has proved almost wholly without efficacy in the treatment of human tetanus; so different from the marked success of the antitoxin of diphtheria in the treatment of that disease. The reason for this unfortunate difference is that the antitoxin to diphtheria is administered within but a short time of the infection, and that it is successful in proportion to its very early use; but in the case of tetanus antitoxin the disease has already been incubating for a number of days, if not weeks, before we know that tetanus is impending. This does not, however, militate against the use of this antitoxin as a prophylactic to be employed when a person has received what may be feared as an injection of tetanus toxin through pus from the wound of a tetanus patient, or through an infection of garden earth.

We read of so-called idiopathic tetanus because no discoverable source or internal lesion can be identified as the seat of the infection. I treated a patient once whose only trouble was a chronic discharge from his right ear. In him all of the ordinary accompaniments of the disease were strikingly manifested, and he had to be constantly watched lest the spasm come on in the muscles of the back and of the extremities, which would throw him out of bed, using his left heel as the pivot for his movements. He finally recovered under doses of potassium bromid amounting to 480 gr. a day for three days, and gradually diminishing these doses for a week afterward.

The incubation period varies very much according to the climate, being much shorter in hot than in temperate climates.

Symptoms.—In many cases there are prodromal symptoms for several days to a week, during which the patient is much disturbed in his sleep, with terrifying dreams; the earliest symptoms are those with stiffness about the neck, with gradually increasing difficulty in opening the mouth, until finally trismus or lock-jaw is fully developed. This may be so extreme that teeth have been removed in order to allow liquid food to be passed in a tube over the tongue. Next in order comes tetanic spasm of the muscles of the back, and then of the extremities. Previous to that the muscles of the front of the abdomen become rigid, and an acute pain occurs from spasm of the diaphragm, beginning in front and passing to the back. The affected muscles never wholly relax, but every now and then tetanic spasms in them are aggravated by paroxysms of severe muscular contractions, which are sometimes terrific in their character, the rectus abdominis being found ruptured after death, and not infrequently the bones are fractured at the seat of the muscular attachments. Meanwhile the muscles of the face are affected, and the edges of the mouth are drawn down, causing an expression named “risus sardonicus.” As the muscles of the back become involved along with those of the leg, the whole body may be arched backward, so that it rests upon the occiput and the heel, to which condition the term “opisthotonos” has been given. When the muscles in the front of the abdomen are most affected, the body is bent forward, hence the term “emprosthotonos,” but if the muscles are more affected on one side than on the other, the body is correspondingly turned, and the patient is said to have “pleurosthotonos.” In severe cases the patient may die between the first twenty-four hours and three days, the variations being from ten days to three weeks in chronic cases. When recovery takes place it is always gradual, and more or less unnatural stiffness remains for a long time in the affected muscles.

Death sometimes occurs from actual asphyxia due to the arrest of the respiratory movements of the thorax. Meanwhile, as has already been mentioned, the reflex excitability of the nerves is extraordinarily heightened.

Treatment.—The severe spasms can always be relaxed by the administration of chloroform, but the effects of this drug upon the rest of the system in the degeneration of both heart and kidney forbids its too continuous use. One of the greatest agents at our command for reduction of the reflex excitability is potassium bromid, but to be effective its administration should always be pushed to the extent of an ounce a day, while the further treatment should consist of as absolute an avoidance of exciting causes as is possible, hence the patient should be kept in a dark room, and every movement, either external or internal, as far as practicable, avoided. The pain should be relieved by hypodermics of morphin, and against the great exhaustion produced by the disease the patient should be fed with peptonized milk and nourishing broths.

HYDROPHOBIA

Historically, this disease has been known from remote times. Democritus, of Abdera (500 B. C.), describes it and also speaks of it as affecting certain groups of muscles with spasms like tetanus. After him it is described by Aristotle and other physicians of classical times. Galen (A. D. 131) speaks of it as the worst of diseases. It was early ascribed to the bite of a dog, and the poet Horace mentions its prevalence at the time of the rise of the Dog Star (Sirius).

Through the Middle Ages it was very prevalent in all European countries, but of late has almost disappeared from north Germany and Britain, due to the enforcements of dog-muzzling ordinances. It occurs widely in the United States, and, owing to this fact, American physicians have been able to confirm the discovery in 1903 by Negri of its active agent, so that the diagnosis of rabies can now be established at once by finding the Negri bodies in a dog's brain without waiting, it may be for weeks, for the development of the disease in experimentally inoculated animals.

The Negri bodies are found included in the cytoplasm of the nerve-cells. They are described as rounded or oval in form, having a homogeneous oxyphil "ground substance," containing a central body surrounded by granules. These bodies vary in shape and size from 0.5 to 20 mm. in diameter, and are present in almost all the nerve-cells in the central nervous system. They are certainly not bacteria, but protozoa instead. Owing to their having no cell wall and being very plas-

tic, they can be so minutely divided that they can pass through the pores of a Berkefeld filter. It was from this fact that the virus of hydrophobia was for so long unidentified and classed among the ultra-microscopic filterable viruses. Absorption of this rabic poison may take place even from a healthy mucous surface, such as the conjunctiva and nasal mucous membrane, as shown in experiments on animals.

Apparently, all warm-blooded animals are capable of contracting hydrophobia, including cows and horses. In Syria I found it very prevalent, where cats often communicate it. Well-authenticated cases, both there and in Europe, name the wolf as subject to it, and also the hyena. A physician related to me the case of a man who died from hydrophobia, who insisted that he contracted the disease from a rat which attacked him and bit his fingers.

The incubation period, according to some statements, may be very long, but probably the average ranges between twenty and sixty days. The variations depend mostly upon the part of the body bitten, those about the face in children being the shortest. "At the end of the incubation period the wound (which may before have appeared healed) becomes uncomfortable, there is itching, tingling, and a sense of local heat, which may become almost unbearable; this is usually accompanied by a sharp stinging pain, which may be localized or may follow the course of the nerves" (Sims-Woodhead).

All observers agree that the virus is propagated by the nerves from the periphery to the central nervous system, and not by the lymph-channels or by the blood-current. In this it resembles tetanus. The greater the number of surface nerves in the part bitten, as in the face or tips of the fingers, the sooner the development of the disease. As a rule, however, only about 16 per cent. of persons bitten by a rabid dog contract the disease, because the saliva on the dog's teeth is apt to be wiped off on the clothing of the person.

Symptoms.—The prodromal symptoms are much alike in dog and man. During the early stages, which may last for from two to six days, the prodromal symptoms are feverishness and thirst, the patient becomes exceedingly depressed and anxious, the muscles of the face are drawn and restless, and there is marked pallor; the patient may talk freely, but is constantly taking sighing inspirations, and general surface hyperesthesia comes on. The pulse quickens and the respirations are proportionately hurried and shallow. On the second or third day the symptoms become more pronounced, the patient becomes much more excited; he wanders about in a restless condition, seldom fixing his eyes on anything, with suspicious side glances as though for

some hidden danger. The conjunctiva, like the mucous membrane of the mouth, is markedly congested. In the latter there is an accumulation of thick tenacious mucus, which he is anxious to get rid of. It is then that a great difficulty in swallowing, especially of fluids, comes on, but though he makes the most determined effort to drink, the moment the fluid comes in contact with the fauces it is expelled with violence, when severe spasmodic contractions of the muscles of deglutition and of ordinary respiration come on, in which a general tetanic state with marked opisthotonos and a stoppage in breathing may occur. In many cases the mere sight of water causes such terror that the patient seeks to avoid it. At this stage a patient often becomes delirious with maniacal attacks, during which he may try to kill his attendants. The excitement sometimes suddenly subsides, because during the spasms a patient may sink and die. In other instances, both in man and in the dog, marked paralytic symptoms show themselves in certain groups of muscles, occasionally taking the form of Landry's ascending paralysis. The dread of this fatal disease naturally may fill persons' minds, who have been bitten by a dog, with such apprehensions that they are attacked with a form of maniacal hysteria, in which they imagine that they have the disease, and refuse to touch water, which they claim brings on spasms in the throat. These cases, however, may soon be correctly diagnosed as due to imaginary fears, so that in the course of a week or ten days the absence of the symptoms of true hydrophobia should lead to the treatment of a patient as a case of hysteria.

Treatment.—There is no treatment for this fearful complaint, and the best course is to keep the patient continuously under chloroform and hypodermics of morphin.

TRYPANOSOMIASIS (SLEEPING SICKNESS)

One of the most remarkable instances of diseases propagated by inoculation through bites of insects, similar in its way to the infection by animal parasites in human malaria, is the propagation of trypanosomiasis by the bites of different species of the tsetse fly. The world was first informed of such infections by the great African explorer, Livingstone, who minutely described the ravages produced in cattle and in horses by the bite of a fly, so that at that time precautions were adopted to prevent such domestic animals from entering districts where the tsetse fly abounded. Subsequent writers described similar infection of the blood of horses in a disease called surra, but it was not, however, until the formidable disease called the sleeping sickness

among human beings was recognized as proceeding from the bites of tsetse flies that the attention of governments was drawn to the subject, and scientific investigators were despatched to districts on the west coast of Africa, where it was first known, and from which it was propagated by the opening up of that continent through the Congo Basin into the regions of Uganda and Rhodesia.

Different species of the tsetse fly are known to infect large game animals throughout wide districts of Africa, and an interesting question arises whether the disappearance or extinction of many large forms of animal life in past geologic periods may not have been due to these same insects, because tsetse flies have been found embedded in the strata of the Miocene Period in Colorado; a not improbable surmise, considering the terrible ravages produced by the sleeping sickness in Uganda in our own times.

Like the mosquito in propagating malaria, it does not originate that disease, but is simply a "carrier" of it from the infected to the well, so the tsetse fly carries the sleeping sickness only from animals or persons whose blood is already charged with the trypanosome parasite. It has been surmised that the blood of the crocodile, on which the fly settles, is the original source of the infection. Numerous varieties of tsetse flies have been captured and kept in confinement for long periods, and then set free to bite animals or even human beings, without any subsequent injury, but when they were left to bite the infected animals an interval of twenty days would elapse before the flies themselves became infective. When they did so, they appeared to have the power of infecting for the rest of their lives, some cases being reported of such power of infecting being kept for three years by a single fly. In a great many wild animals, though they are infected, the presence of the parasite in the blood does not seem to occasion much harm; nevertheless when the infection is conveyed from them to other species, and notably to human bodies, the most disastrous results follow.

In the case of the human being the ordinary mode of infection has been by the fly called *Palpalis gambiense*, but lately it has been shown that another species, called *morsitans*, is also capable of propagating the disease, and it is a question whether still other species of this fly may not also be able to infect.

The parasites of the different species of trypanosomes are to be found in the cerebrospinal fluid, and less often in the blood. There can be little doubt that the cycle of development occurs in the body of the tsetse fly in a way very similar to the development of the malarial

parasites in the body of the mosquito, though all of the stages of that development have not been worked out. The blood of healthy persons may contain this parasite, just as in the case of malarial infection, without producing many symptoms, but when they do, the disease may be clinically described as consisting of three stages, preceded by a period of incubation which may be very chronic. When the disease sets in, however, the first symptoms are chiefly nervous, the pulse being quickened and the mind becoming lethargic, this lethargy deepening with the chronic progress of the disease through a stage marked especially by muscular tremors; and, lastly, by a profound lethargy which ends in death. Among the names of some of the scientific investigators of this remarkable disease we shall mention Koch, Bruce, Nebarro, Evans, Todd, Dutton, and others.

Dutton found a trypanosome in the blood of a West Indian in 1901, but in 1902 Castellani demonstrated trypanosomes in the cerebrospinal fluid of 5 cases of the African sleeping sickness.

Treatment.—As to treatment, the results at first of the injections of atoxyl, recommended by Koch, seemed to be very promising, but relapses were very frequent, and evidently due to the larval or younger forms of the infection not being affected by this medicinal poison. A more serious complication, however, was that atoxyl in time produced total blindness, accompanied by atrophy of the optic nerve.

More recently salvarsan has been recommended, from its known power of dealing with all parasitic protozoa, and already numerous cases of actual cures have been reported from its use.

The incubation period is very uncertain and may be prolonged. A negro boy from the Congo died of the disease at a training-school at Colwyn Bay, North Wales, although he had resided for three years in Wales in good health before the symptoms declared themselves. This infection, after proceeding up the Congo Basin, finally entered Uganda, where it is estimated that 100,000 of the inhabitants died from it. The average duration of the disease is about a year, but may last for eighteen months.

KALA-AZAR

Our review of the diseases infecting the human race by means of the bites of insects covered a truly formidable list, beginning with the bubonic plague, transmitted by fleas which have bitten sick rats. Then the long list of malarial diseases caused by the bite of a mosquito; yellow fever, caused by the bite of another species of mosquito; the sleeping sickness of Africa, caused by the bite of a tsetse fly; and now, lastly, the most formidable of all, for its high percentage of

death, namely, kala-azar, caused by the bite of a bedbug. This disease prevails most extensively in the valley of Assam and in neighboring districts of eastern India, but is also reported from parts of China. This parasite was first identified by Leishman and also by Donovan in 1903. It consists of oval or oat-shaped bodies, with two collections of chromatin granules, appearing on opposite sides of the cell.

Symptoms.—A great enlargement of the spleen is always found, and to a less degree enlargement of the liver. The disease begins with a high fever, which is soon accompanied by the characteristic enlargement of the spleen, in which organ the parasite is found in immense numbers. Irregular pigmentations of the skin also occur in the course of the disease. The bone-marrow is, moreover, invaded by the parasites, largely explaining the rapid development of anemia, which may be accompanied by interstitial hemorrhages. Owing to this anemia, degeneration of all muscular tissues, including that of the heart, occurs. The fever lasts for several weeks, followed by apparent remissions, to end, however, with a return of the fever again, until the patient sinks, owing to the general blood destruction, its course being occasionally shortened by intercurrent complications. The mortality is very high, so that it is doubtful if any patients recover from the infection.

Europeans are but rarely affected, as they do not come in contact with the sick. The only effective prophylactic measures are to set fire to the infected huts, and as to treatment, the only measure that is represented to be beneficial is by large doses of quinin, which are said to modify or to shorten the febrile attacks.

Treatment.—Though not mentioned by authors, salvarsan, given intravenously, might be tried, owing to its demonstrated power over protozoal infections.

ROCKY MOUNTAIN FEVER

This localized or endemic disease, which prevails only in the mountainous regions of Montana and Idaho, has some very peculiar features, one of which is its extraordinary severity in Montana, where the death-rate is reputed to be 70 per cent. from it, while in the adjacent state of Idaho the same disease causes only 2 per cent. of deaths. It is agreed by all investigators that it is communicated to man by the bite of a tick. It has been experimentally communicated to guinea-pigs and to monkeys, and further, one attack produces immunity from any subsequent infection.

Symptoms.—Clinically, it goes through the usual stages of such infection in having an incubation period of from three to ten days, when it then sets in with fever rising to 104° and 105° F., with general pains, often accompanied by delirium. The special feature, however, is an eruption which closely resembles that of the old typhus fever, being macular, and in many cases it becomes hemorrhagic. It was unfortunate, on that account, that some observers actually called it typhus. Typhus fever is altogether distinct from this affection, both in its origin and in its being highly contagious. The duration of this Rocky Mountain fever is ordinarily four weeks.

Treatment.—As quinin has proved of no avail, the treatment must be simply symptomatic.

SURGICAL INFECTIONS

The skin at all times swarms with micro-organisms, such as streptococci and staphylococci, which could induce serious or fatal general infections of the body whenever a surgeon makes an incision into it. When I first became a physician it was universally believed that such infections by pyogenic organisms were inevitable, and, therefore, that the formation of pus after a surgical operation was so constant that the resultant pus itself was divided into such imaginary classes as laudable pus and grumous pus.

It was Lister who first demonstrated that no surgical operation need be followed by any pus if the surgeon first took precautions for disinfecting the skin by various measures which he recommended. At first he operated only while the cutaneous surface was enveloped in a cloud of disinfecting spray. Later it was proved that this spray was unnecessary, and that by diligently washing the skin to be incised with carbolic acid or corrosive sublimate solutions, but, above all, by the surgeon disinfecting his own fingers, the most extensive incisions through the skin might be made without causing any of the dangerous infections of former days. As it is difficult thoroughly to sterilize the fingers, surgeons are now accustomed to wear sterilized India-rubber gloves while they operate. These and similar measures of antiseptic surgery have effectually abolished surgical infections.

CHAPTER V

INFECTIONS BY THE BACILLUS COLI

MODERN surgery has discovered that the surface of the skin swarms with millions of micro-organisms which can be the most certain causes of disease and death, if once they could gain admission through the layers of healthy skin. But, on the other hand, the lining of the intestines swarms with corresponding micro-organisms which could produce every variety of serious infection, if only they could find entrance through the mucous membrane into the circulation. Among such intestinal micro-organisms is the *Bacillus coli*, long supposed to be a harmless resident of the intestines, because in normal conditions it produces no morbid symptoms, yet pyogenic cocci which abound on the skin do not affect the constitution until the way is opened for their entrance by some skin lesion or by a surgeon's incision. All the triumphs of modern surgery have come from the surgeon's making the skin aseptic before he cuts into it, or, as it is technically stated, by sterilizing the skin. In the intestines such sterilization is impracticable, and only very recently have we discovered how the *Bacillus coli* can penetrate mucous membranes and gain entrance into the circulation, thus producing a great variety of infections whose nature and origin were, till lately, fully obscure. Thus, the kidneys may be invaded by this bacillus, with the result of producing a great number of small, scattered abscesses through this substance, from which the *Bacillus coli* can be isolated in pure culture, as we shall note further on.

One peculiarity is by no means uncommon in the appearance of the urine, which is highly acid and has no ammoniacal odor, but instead has a special appearance, as if it held minute whitish substances in suspension. On examination by the microscope with proper reagents they prove to consist of millions of the *Bacillus coli*.

I was once called in consultation by Dr. Robert Abbe to see a lady who presented symptoms of cerebral disorder, along with febrile temperature. This condition of the urine in her continued, notwithstanding measures, to be mentioned presently, which had always been successful in ridding the urine of the *Bacillus coli*. The whole problem was subsequently solved by an attack of severe appendicitis.

When Dr. Abbe operated to remove the appendix, a broad ulcer at the attachment of the appendix to the cecum plainly showed where the bacillus had gained entrance into the circulation. After the operation the remedies quickly relieved the patient of every trace of her special infection.

One of the results of acute infection by this organism is a sudden development of cerebral symptoms, soon passing into coma and high fever.

I was once called in consultation by two physicians to see a lady over fifty who was comatose with a temperature of 105° F. They stated that her urine was highly albuminous and that for some years she had suffered from chronic colitis. On examining the patient I felt sure it was a condition of acute nephritis caused from infection by the *Bacillus coli*, and recommended my usual treatment for such cases. This was followed by rapid and complete recovery.

If it can be shown, however, that the patient has previously suffered from chronic ulcerative conditions of the intestine, the prognosis is good. But in one case, that of a physician who had already consulted me for ulcerative colitis, I was called to see him by his physicians, who told me that for seven weeks he had been so continuously delirious that his attendants had to watch him day and night. Meantime his urine had been daily examined at a well-equipped laboratory, and found constantly to contain much albumin, with blood and tube-casts. Their report, therefore, was uniform with the diagnosis of severe parenchymatous nephritis. On my examining him, I said this was a laboratory and not a clinical diagnosis, because his pulse was soft and he had no sign of dropsy. Meantime I gave a favorable prognosis, and prescribed my usual remedies for infection by the *Bacillus coli*. The report from the laboratory on the second day after the treatment began was, "Astonishing improvement; no albumin, no blood, and no casts." Six weeks afterward this physician called upon me wholly free from any symptoms.

One hardly knows what the colon bacillus will not do when once it starts on its travels in the circulation. Dr. Robert T. Morris, the well-known surgeon of New York, reports in the "New York Medical Journal," January 1, 1910, the case of a patient, an elderly clergyman, referred to him by Dr. S. Kirchendal, of Ithaca, N. Y., as a sufferer from choroiditis, which threatened to end in total blindness. In his letter to Dr. Morris, Dr. Kirchendal says that Dr. Stockton, of Buffalo, has long maintained that the colon bacillus was the cause of most cases of choroiditis. Dr. Morris found that his patient had been suffer-

ing for years from intestinal troubles accompanied by symptoms of chronic appendicitis, and on Dr. Morris' removing the appendix the patient recovered, not only from his intestinal troubles, but also from his choroiditis.

Recent medical literature abounds with references to serious effects of invasion of the *Bacillus coli* in producing extensive organic changes between different pelvic viscera. In the London "Lancet" of October 30, 1909, Dr. F. Charlton Briscoe, Physician to Kings College Hospital, London, relates several instances of a matting together of the pelvic viscera by an exudate, showing caseous changes which led to mistaken diagnosis of their tuberculous nature, but which proved, on microscopic examination, to be caused by the *Bacillus coli*. In each case colon bacilli were found abundantly in the urine. Among other cases there was that of a young girl, in whom on operation a large mass of caseous material was found attached to the small intestine, great omentum, left ovary, and tube. This was thought to be surely tuberculous, but on examination no tubercle bacilli were found, but instead a structureless material from which pure cultures of colon bacilli were obtained. He also refers to an interesting group of cases which have attacks of intermittent fever, but which prove so commonly to be due to colon infection that he advises the urine to be examined for the colon bacilli in all cases of febrile attacks of obscure origin.

Likewise, Dr. H. Batty Shaw, Physician to the University College Hospital, London, gives the particulars of 7 cases of his own which may have been supposed to be sufferers from malaria, tuberculosis, mucous colitis, cystitis, acute suppressions, or pernicious anemia, and yet which, on examination of the urine, proved to be cases of infection by the *Bacillus coli*.

As might be expected, invasion of the kidney by the *Bacillus coli* is not an uncommon, and sometimes a fatal, complication of typhoid fever in its later stages, when the intestine is extensively ulcerated. Its supervention should be suspected when markedly increased albuminuria is detected along with excess of delirium. One symptom is an almost certain sign, namely, the occurrence of severe rigors late in the typhoid fever. During these attacks the patient seems on the verge of dissolution, and yet they are not necessarily fatal, particularly in young subjects. Free dosing with spirit of chloroform cuts the rigors short. In older patients the prognosis is worse and in one case of my own, that of a lady about fifty who soon died, the bacteriologist reported that he had never seen such a vast collection of the colon bacilli as there was in her urine.

As regards chronic infection by the *Bacillus coli*, we would refer to an important paper in the "Journal of Medical Research," November, 1902, by Dr. A. Charlton, from the pathologic laboratories of the McGill University, with the title "The Anemia Produced by Repeated Injections of Cultures of a Colon Bacillus of a Low Virulence." Rabbits were used for experiments with the colon bacillus derived from their own intestines; the cultures therefrom were injected into a vein of the ear. The doses were always small during a period of experimentation extending over many weeks. The results were a very remarkable state of advanced anemia, in some respects strikingly like the condition found in pernicious anemia, namely, great diminution in the number of red cells, marked poikilocytosis, and the appearance of crescents, macrocytes, microcytes, and, lastly, nucleated red cells. On suspending the injections for some weeks, even when the fall in the red cells was from 5,500,000 to only 1,500,000, spontaneous recovery took place. Then when the injection of the bacilli was resumed, the injurious results were even more marked than on the first trial. But in addition to the effects on the blood, very striking and progressive changes were produced in the spinal cord, consisting of diffuse degeneration in the columns of Goll, closely resembling the conditions occurring in the spinal cord in pernicious anemia.

One of the commonest causes of infection by the *Bacillus coli* is chronic constipation, which may be obstinate and prolonged for many years, especially among women. I have found this bacillus abounding in the urine, though there was no apparent ulceration present in the mucous membrane of the intestines, showing that, like the tubercle bacillus, the *Bacillus coli* can make its way into the circulation without any noticeable lesion in the intestinal wall.

Treatment.—The treatment of infections by the *Bacillus coli* of the urinary tract from the kidneys down is fortunately very plain. We possess in urotropin a prompt and effective poison for this bacillus, which, moreover, is itself secreted from the blood by the kidneys. I have found, however, that urotropin itself often irritates the urinary passages, in some cases even producing strangury, but this complication can be almost certainly prevented by combining the urotropin with the same amount of benzoate of soda, as this makes a combination which is very soluble in water and is also tasteless. My usual dose is 10 gr. of urotropin and 10 gr. of sodium benzoate, to be given in water or in Vichy, an hour after each meal and at bedtime. In the case of children half the dose may be sufficient.

Many cases of enuresis in children have been reported as the

result of infection by the *Bacillus coli*, and these have been equally benefited by this combination.

Some writers have advocated the use of vaccines made from cultures of the bacilli supplied by the patients themselves, but I have never had occasion to resort to them.

I have little doubt that many cases of chronic interstitial nephritis are caused directly by the action of the *Bacillus coli*. It is in these patients also that sudden attacks of exacerbation of previous kidney disease follows upon errors of diet. I therefore always feel concerned when I hear of an attack of cholera morbus in an elderly person, and direct that the condition of the kidney shall be immediately investigated, for not infrequently total suppression follows such attacks. In such cases we cannot be too prompt in recourse to rectal irrigation with Kemp's rectal irrigator, using from 2 to 4 gallons at a time, every four hours, besides dry cupping over the kidneys both before and behind, as well as the administration of urotropin and benzoate of soda every three or four hours, given per rectum, in cases of vomiting or coma, these drugs being very soluble and suspended in enema of 4 to 6 oz. of normal saline.

PART III

DISEASES OF SPECIAL TISSUES OR ORGANS

CHAPTER I

DISEASES OF THE BLOOD

CHLOROSIS

THE first subject to note about this disorder is that it usually occurs in young women not long after the establishment of the menstrual functions, and then is prone to relapse during the subsequent years, from fifteen to thirty. This fact of itself shows that it is intimately associated with the constitutional conditions accompanying menstruation, and its origin, therefore, must be sought for in those conditions. In a typical case of chlorosis the condition of the blood-corpuscles is characteristic in showing a marked deficiency of hemoglobin, without any other special changes. We speak of this because while in many advanced cases of this disease there may be an actual diminution in the proportion of the red corpuscles, yet the rule is that the corpuscles are found in about their normal proportions in the blood, while the other constituents are not only unaffected, but may be relatively increased, so that the volume of the blood may be more than in health, constituting what is called chlorotic plethora. Chlorotic girls, therefore, do not show any trace of emaciation, as they do in other anemias, but are plump, and with the pulse quite full, if not even incompressible. The chief symptoms which they complain of are breathlessness, owing to the deficient oxygen-carrying property of their corpuscles, along with palpitation of the heart, and a more or less pronounced muscular debility. Their complexion also often has a greenish-yellow tinge, which has given to it the name chlorosis. This is in no sense a form of jaundice, for the sclerotics are very clear.

As a clinical fact, there is a close relation of the female generative organs with the innervation of the organs of digestion. Thus, the beginning of pregnancy is often accompanied by persistent nausea or vomiting, but in no morbid condition is this fact more often illustrated than

in chlorosis, which may be characterized by the supervention of the same strange perversions to eat all sorts of indigestible substances, including slate pencils. I published a remarkable case of a girl who was caught in a cold thunder shower while she was menstruating. This was followed by loud borborygmi, or rumbling of the bowels, which greatly annoyed her at school, accompanied by complete constipation, resisting the administration of the most active cathartics. Finally, when the bowels did move, the passages were totally devoid of any color, so that they resembled lime plaster. Vomiting then occurred, which in time became stercoraceous, and these, with other external derangements of the secretions, continued till her death five months afterward. Postmortem examination showed no stricture or other obstruction in the bowel. In her case the first disturbance was an apparent paralysis of the peristaltic movement of the bowels, and obstinate constipation is such a common, but not invariable, accompaniment of chlorosis that Sir Andrew Clark ascribed the whole disease to toxic absorption of fecal products in the large intestine.

One of the accompaniments of chlorosis is a curious tendency to the formation of thrombi in the veins. These thrombi, however, differ altogether from the infected and dangerous thrombi that occur in septic conditions of the blood, because chlorotic thrombi are always found to be sterile, and generally subside without producing any serious results, even on the walls of the veins where they form. In one hospital patient of mine I found 28 such thrombi in different parts of the body, but, as a rule, the prognosis of the recovery in their case is good, and they are best treated by painting the course of the affected vein with tincture of iodine. It is far otherwise, however, if the thrombi are formed in the cerebral sinuses of chlorotics, for these may cause unexpected death.

Treatment.—Many cases of the disease begin with a chill of the feet, as we have explained in our chapter on Catching Cold. Dry, not moist, heat applied to the feet should then be assiduously employed. Many chlorotic girls, for long periods before the disorder becomes established, will be found to have suffered from cold feet, remaining so for a long time after retiring. These patients should, therefore, have their feet warmed before retiring, and should be cautioned against remaining in their stocking feet for any length of time before getting into bed. A heated soapstone or bottles of hot water should be put in the bed, especially during the winter weather. The bowels should be kept open by aloëtic laxatives, of which the small laxative pill of aloes and strychnin is a good preparation.

Like other processes of metabolism, the assimilation of iron in chlorosis is wholly unexplained. The doses of iron which are administered are many times as large as the physiologic dose of iron which we daily take in our food. This great excess of iron colors the feces black as it is got rid of by the intestine. Nevertheless in chlorosis we must administer relatively immense doses of iron to combat the disease. But none of the fancy organic preparations of iron will compare with the old sulphate for efficiency in chlorosis. We may begin with 3 gr. three times a day after meals, but soon increase, until the dose is 5 gr., and continue this treatment for four weeks, after which the dose may be decreased to 3 gr., and kept up for at least three months, so as to forestall relapses. It should be remembered that relapses in chlorosis are frequent, but generally from the patients leaving off the remedy before the cure is attained. Along with the administration of iron it is well to administer 1 gr. of quinin with 1 gr. of powdered nuxvomica, in pill form, to be taken before meals, with a full dose of dilute hydrochloric acid of from 10 to 15 drops.

The undoubted success of giving iron in chlorotic anemia has injuriously led to the administration of iron for every form of anemia. But iron is positively mischievous in all anemias associated with fever, and hence aggravates the anemia of tuberculosis. Cod-liver oil, as was long ago pointed out by Simon, especially in the anemias of children, is a much more effective agent for enriching the blood with red corpuscles than iron, and iron is not only useless, but actually harmful, in pernicious anemia.

It is the disproportionate growth of the brain in the human species in early life that causes a large proportion of deaths in childhood. The blood in children, especially between the second and seventh years, is poorer in its proportion of red corpuscles than it will be again during life. This is due to the great drain upon the blood produced by the rapid growth of the brain, because no organ of the body, except the pregnant uterus, grows so rapidly as does the brain during that period of life, so that its full weight is attained by the end of the seventh year. Not only does the brain then increase so disproportionately in size to the rest of the body, but it also does more and better work than it will ever do again during life. For not only does it acquire language then, but also its greatest store of ideas and memories. In starvation the only tissue of the body that does not lose bulk is the nervous tissue. Being the royal tissue, it will have its supply of blood, however seriously the other tissues may be starved. Hence it is due to this drain upon the blood that those serious disorders of nutrition occur which

are characteristic of childhood, such as mucous catarrhs, diseases of the skin, ulceration of the cornea, and of other cartilaginous tissues connected with joints. For them it is cod-liver oil which should be administered and not iron. Moreover, children generally show a remarkable taste for cod-liver oil, showing that there is a positive liking for it which surprises their parents, just as parents are surprised on finding that the boy will wear about the same sized hat as his father.

ANEMIAS, PRIMARY AND SECONDARY

The commonest affections of the blood are the anemias, which may be divided into the primary anemias, and the class of secondary anemias. The secondary anemias include all those cases of impoverishment of the blood due to febrile infections, such as malaria, rheumatism, tuberculosis, and the acute fevers, also the anemias of toxic origin, such as chronic lead- and arsenic-poisoning. The primary anemias are those due to perversions in the blood-making organs or tissues, as in chlorosis or in pernicious anemia, though it is very probable that toxemias of various kinds have a share in the causation of the disorder.

The red corpuscles of the blood arise from different tissues in the course of life, those in the vascular area surrounding the embryo in its early stage being different from those in the uterine or postnatal life, though they all have in common that remarkable substance called hemoglobin. A molecule of hemoglobin stands alone among organic compounds, owing to its huge size, for it contains no less than 2304 atoms, composed of 1130 atoms of hydrogen, 712 atoms of carbon, 245 atoms of oxygen, 214 of nitrogen, 2 of sulphur, and 1 of iron, and if it were not for that one atom of iron it would not have its characteristic red color, nor would it be the oxygen carrier of the blood. During postnatal and adult life the chief source of the red corpuscles is from the red bone-marrow, especially in the ribs. In this marrow are found relatively large corpuscles which are at first pale, but soon become colored. Some of these corpuscles are nucleated, others, of smaller size, are called normoblasts, while others are free, non-nucleated, biconcave disks, which constitute the chief mass of the red corpuscles of the blood. A peculiarity of the red corpuscles is that they are short lived, and appear to be destroyed in the spleen and in the liver. There is no doubt that rapid destruction of the red corpuscles may occur from the action of the nervous system alone. Two competent observers of my acquaintance counted the proportion of the red corpuscles, in an evening, when they proposed to sit up all night with a patient,

who was passing through a serious crisis in his illness. Then on counting the corpuscles again, in the morning, they found the average loss to have been more than 15 per cent. This explains, also, the frequent occurrence of abundant, pale, and neutral urine after nervous strain. This urine not only will contain an excess of phosphates, but, upon boiling with a strong mineral acid, will turn a blood-red color, due to the hematin dissolved and decolorized in the urine, but which color the strong acid restores, and it can be extracted by ether, this hematin being an active diuretic. I have thus suspected that some cases of chronic kidney trouble, occurring in persons subject to much mental strain, may originate from prolonged stimulation by the nervous system.

The secondary anemias need not here long detain us, as they are due very commonly to infections such as malaria, etc., above mentioned, and which, therefore, will be spoken of as we treat their various causes.

PERNICIOUS ANEMIA

Pernicious anemia is due to a specific change in the blood, first described by the great English physician Addison. It is characterized by changes in the red corpuscles which are truly specific, not only being reduced in number beyond what they are in any other anemia—in Quincke's case down to 143,000 per c.mm.—but the corpuscles are characteristically altered in their shape more than what occurs in any other known disease. This condition, which also occurs in other anemias, but never to such an extent, has been called *poikilocytosis*, the corpuscles departing widely from their natural form. In pernicious anemia they are characterized by their abnormally increased size, so that they are called megaloblasts, though some of them may be smaller, so as to be called normoblasts, or even microcytes. One peculiarity of pernicious anemia, which so differs from the corpuscles of chlorosis, is that the percentage of hemoglobin is usually high, so that some of the microcytes present a brilliant red appearance.

Clinical Course.—This disease occurs mostly in persons beyond middle life, and more in men than in women. It is, however, characterized by remarkable remissions which last for months, with an increased formation of blood-corpuscles, so as to give deceptive hopes of recovery. During these remissions the blood count materially rises, but the serious ultimate prognosis still obtains from the presence in the blood of nucleated red corpuscles as well as the megaloblasts. The white corpuscles are generally decreased in number, especially in the proportion of polynuclears. The onset of the disease is always slow

and insidious, the patients not feeling unwell or debilitated until the languor caused by their serious anemia leads them to consult a physician, when an examination of the blood first demonstrates the seriousness of their condition.

Unlike most other anemias, there is no loss of flesh, and scarcely any other palpable sign of the disease, except occasionally edema of the feet. In pernicious anemia the muscular tissues have a characteristic red color, and the face also has a reddish tinge. The greatest change is found in the bone-marrow, which is greatly wasted, and contains an excess of large nucleated blood-corpuscles, as if the marrow were making an extra effort to replenish the blood. Coincident with these changes, and by some stated to precede the other alterations, are extensive degenerations in the spinal cord, particularly of the posterior and lateral columns, so that some of these cases have been mistaken for tabes. The skin is generally of a lemon color, but this cannot be confounded with jaundice, because the sclerotics are of a pearly white. One characteristic change is found in the liver, which contains a great excess of iron, and which may have a bearing upon the obscure etiology of the disease, as indicating some active hemolytic poison in the intestinal tract. The urine also, but not always, is of a dark red color, said to be due to an excess of urobilin.

Etiology.—The etiology of this complaint is very obscure. Hunter claims that its most frequent cause is an atrophy of the gastric secretory tubules, brought about by the constant swallowing of highly infected pus from the roots of decayed teeth. He claims that a further indication of this condition is furnished by an extensive inflammation of the tongue, or chronic glossitis. While there may be no doubt that this contention is true in numerous cases of a severe anemia with accompanying blood changes, yet some changes of pernicious anemia show no evidence of the infections, either from the mouth or atrophic changes in the stomach, and we are compelled to ascribe the disease to the genesis of an unknown hemolytic poison, most probably generated in the intestinal tract. This, however, does not explain the singular remissions, which in no sense are intermissions like those which may occur in malarial affections. Pernicious anemia is also a febrile disease, the thermometer often ranging from 101° to 102.5° F., without any constant connection with the occurrence of remissions. These remissions, in fact, constitute one of the most obscure features of the complaint. As in other grave anemias, the heart walls show patches of fatty degeneration, and death occurs from pure muscular debility, and not from intercurrent diseases.

Treatment.—The only remedy which has any reputation is arsenic; iron, from what we have already said, being contra-indicated in the treatment, as in all other febrile complaints. The administration of arsenic may begin with 5 drops of Fowler's solution, three times a day, gradually increased to the point of tolerance by the stomach. Some recommend no less than 20 drops at a dose. In one of my cases remarkable improvement occurred for a time from the administration of bone-marrow, but ultimately this failed and the patient died with all the symptoms of extreme impoverishment of the blood.

LEUKEMIA

In the most secluded and jealously protected parts of the body are the tissues which constitute the bone-marrow, whose relations to the life of the body are so important that they fully explain their position. It is in the bone-marrow that we find the beginnings of the blood, and the specific relations of this vital element to the whole body. In other words, the bone-marrow is the most living part of our physical frame, and it is equally important for the elucidation of problems both in health and in disease. The bone-marrow is virtually a tissue by itself.

The marrow is pinkish in color, soft and friable, and very richly supplied with blood-vessels derived from the central medullary artery.

"It is in the red bone-marrow that the hemoglobin of the blood is developed, as are also the granular and perhaps some of the other forms of white blood-corpuscles" (Dickson). This red bone-marrow occupies the flat bones and the extremities of the long bones. Thus it is the sole source of the red cells and the main source of the white cells in postnatal life. It would seem that there is an antagonism between the processes of the formation of the red cells and of the white cells of the blood, for in leukemia we find a great excess of white cells, but a progressive decline of the red cells.

This fatal disorder of the blood is not restricted to the human species, but "occurs in dogs, cats, horses, cattle, sheep, goats, and rats, and a somewhat analogous condition is found in fowls" (Gulland and Goodall). This fact is without a parallel in any other disease, and shows that the processes in blood making are essentially the same throughout all the vertebrates. It also indicates how deep seated the disorder must be, for the blood is the most vital element in animal life, and it is now proposed that the specific chemical reaction of a single drop of blood should be made the basis of zoölogic classification. On this account the etiology and pathology of leukemia must be un-

known, and what remains for us is rather to study its different clinical forms. Of those clinical forms the most commonly recognized is that in which the spleen is enlarged and inflamed, so that it frequently forms adhesions to surrounding parts. But this fact throws no light on the nature of this disease, for the spleen is an organ which is not necessary to life, and has been both experimentally removed in animals and surgically excised in man without serious results, which would be impossible in the case of organs so much smaller than the spleen, as the adrenals. No splenic disease, therefore, can be the cause of leukemia, but enlargement of the spleen so frequently enters into the picture of this complaint as to give the name "splenomedullary" to one variety. The real seat of the disease is in the bone-marrow, the chief source of the corpuscular elements of the blood.

Another clinical form is that in which the lymphatic glands and the whole lymphoid tissue of the body is implicated. As a rule, this form is more rapidly fatal than the previous one, but is also so associated with the same changes in the bone-marrow as the previous form that it is a question whether there is any essential difference in the conditions underlying these two varieties of leukemia.

Symptoms.—As a rule, the onset of this disease is so insidious that its actual beginning may not come under the notice of the physician. Not infrequently the patients feel quite well, and continue in their avocations wholly unaware of the disastrous changes which have already happened to them in their blood. Quincke's extraordinary case is referred to by all authors, where, instead of the red cells numbering 5,000,000, they amounted to only 143,000 per c.mm., and yet the patient did not know that he was seriously ill. The diagnosis of leukemia, therefore, cannot be made from its symptoms, but only by microscopic examination of the blood.

Under the microscope the first fact of importance is a great relative increase of the white corpuscles. Instead of 1 white corpuscle to 800 red corpuscles, the proportion may be 1 to 200, 1 to 50, or even 1 to 1. Cases have been reported where the white corpuscles have exceeded the number of red, but, besides this, the red may be actually diminished much below 1,000,000 to the c.mm. In addition to these changes, new forms of corpuscles not found in normal blood make their appearance. Sometimes the red corpuscles are nucleated; at other times very large forms are found, called megaloblasts. White corpuscles, called myelocytes, unlike those found in normal blood, appear in great numbers. These myelocytes show scarcely any of the ameboid movements, and are not colored by basophilic stains. Poikilocytosis also appears, but is not so common as in pernicious anemia.

The symptoms which ordinarily cause a patient to consult a physician are those of general debility, as might be expected from the progressive anemia, but very commonly there is a tendency to various hemorrhages, particularly epistaxis. A similar tendency occurs in the gums, but the most dangerous form is from hemorrhage in the stomach, sudden fatal hematemesis having been reported as a first sign of the complaint, and found postmortem to be without any connection with gastric ulcer. In other cases ecchymoses and true purpuric spots appear under the skin.

The ordinary duration of this disease is from two to three years, but occasionally acute forms appear, one of which I published in the "New York Medical Record," March 5, 1898, of a married woman, aged twenty-one, whose first symptom of illness came on three weeks before she was admitted on June 8th, and who died on June 19th. She had a temperature of 105.6° F. on admission. The spleen could scarcely be felt, and there were no enlarged lymphatic glands palpable, nor any cutaneous ecchymoses. The first blood-count made the morning after admission was 1,400,000 red cells per c.mm., and hemoglobin only 27 per cent. She had repeated attacks of vomiting, which continued until her death. The liver showed an enormous collection of large mononuclear cells, while the parenchymatous liver cells were remarkably fatty. The chief change, however, was in the bone-marrow, the shaft of the femur containing almost diffuent, light-colored, bloodless marrow, which could with difficulty be distinguished from pus, on the one hand, and fat on the other. Taking this case as a whole, there was no doubt of its being leukemia, from the presence of special forms of cells above described and also myelocytes, yet the high fever along with the other features of the attack strongly suggested some infective process.

Treatment.—For the treatment of this disease the most favorable report is from the employment of the x-rays, though it is difficult to explain the mechanism, so to speak, of this agent. Dr. R. C. Cabot, in Osler's "System," speaks enthusiastically on this subject.

HEMOPHILIA

This remarkable affection of apparently causeless bleeding is strangely limited to the male sex, but it is equally strange that it occurs only in boys who inherit a family tendency to the complaint through their mothers, who alone appear to transmit that tendency or, in other words, it comes from the maternal, but not the paternal, side.

In some cases a deficiency has been found in the development of

the muscular layer of the small arteries, while in other cases the blood-vessels are normal in their structure, no change in the blood itself having been conclusively found in the disease. But as it occurs in boys in early childhood, every precaution should then be taken to prevent their receiving injuries causing open wounds of any kind, for uncontrolled hemorrhage has occurred from the extraction of a tooth.

The hemorrhage, however, may occur spontaneously, particularly in the form of epistaxis, but has been known to come from the mouth, and in some cases from the kidney. Cases are also reported in which hemorrhages under the skin closely resembling purpura occur, but the commonest development of the disease is about the joints, which may be easily confounded with various forms of arthritis, being differentiated from them by other manifestations of hemophilia. The true etiology of the complaint, however, is still undiscovered.

Treatment.—Our only measures are in the form of prophylaxis. The prognosis improves with each advancing year; the earlier hemophilia occurs in childhood, the worse the prospect. We seem, however, to have in ergot a promising agent through its effect of contracting peripheral blood-vessels. Wright has shown that the blood in cases of hemophilia takes more than twice the usual time for coagulating, which would seem to be an indication to use the calcium lactate in doses of 10 gr., taken in milk, three or four times a day. I doubt if free doses of tincture of perchlorid of iron, recommended by some, is of any avail. Locally, in cases of epistaxis a strong solution of adrenalin should be persistently employed, while Burroughs & Welcome's tablets of suprarenal extract, recommended in the treatment of Addison's disease, may be tried.

SCURVY

"While the profession is indebted to naval surgeons for the fullest information about scurvy, as it used to prevail on ships, yet extensive epidemics of it have occurred on land, particularly in besieged cities, as in Paris in 1871. The French and English armies also in the Crimea suffered severely, owing to their faulty supplies of provisions. As late as 1795 the British fleet under Lord Howe was endangered by an extensive outbreak among the crews. Scurvy now is a well-nigh extinct disease on sea, due not only to the use of lime-juice, introduced by Sir Gilbert Blanc, but still more, in my opinion, to extensive use of potatoes, conjoined with the great shortening of trips by sea since the introduction of steam."

It was during the long voyages of the 18th century that the rav-

ages of this disease on shipboard were so dreadful. It was not long before experience on a wide scale, both on sea and on land, proved that absence of fresh vegetable food was the chief cause of this disease, and that all that we needed either to prevent or to cure it was the use of fresh vegetables.

Symptoms.—The prodromal symptoms of this now fortunately rare disease are a sense of general muscular weakness with shifting pain in the limbs and back. The skin is dry and rough, and marked by small purple spots, particularly on the thighs and legs, sometimes on the lower limbs exclusively. Besides these spots, there are livid patches which resemble bruises. The tongue may be swollen, and there may be a tendency to diarrhea. The most distinctive of the early signs is found in the state of the gums, which are of a deep red color, soft and vascular, and much swollen. There is a peculiar and characteristic fetor in the breath. Besides the affection of the gums, there is the subcutaneous indurated swelling of the tissues, so that the muscles often seem to be brawny. These lesions are specific to scurvy, as well as those disorders of the skin already described. General weakness of all muscular tissues, including that of the heart, was the commonest cause of death.

INFANTILE SCURVY

Scurvy may occur in all its typical features in infants and growing children, as well as in adults. One of the worst cases which I have seen was in a child who had been fed exclusively with a preparation called Horlick's Malted Milk. These cases can be promptly cured by giving pure milk, and, if necessary, supplemented with Fairchild's essence of pepsin. For a long time infantile scurvy was confounded with rickets, but the characters of this complaint are plainly scorbutic, consisting of intramuscular and especially subperiosteal hemorrhages, most pronounced in the lower limbs.

PURPURA

Purpura is not a disease, but a symptom common to a number of diseases. It consists virtually in an inability of the blood capillaries to retain the blood coursing in them, so that extravasations of blood take place under the skin in many parts of the body, accompanied in some cases by inflammatory swellings of the joints, when it may be difficult to distinguish it from peliosis rheumatica. It is always of toxic origin, and thus it is not uncommon as an accompaniment of jaundice, and may be the cause of a bleeding difficult to control in

operations upon patients with jaundice. At other times it may not be easy to assign the cause of toxemia.

One of the most difficult cases in my practice was that of a lady who, after various signs of purpura, had hematuria so profusely that it threatened her life, but was checked by a hypodermic administration of rabbit's serum.

Many cases of purpura are very mild and may be left to spontaneous recovery. On the other hand, there is a form which may be correctly called purpura fulminans, most commonly met with in children, which may kill the patient within twenty-four hours of the first symptoms. It is characterized chiefly by cutaneous hemorrhages, death occurring before any bleeding takes place from the mucous membranes.

The etiology or causation of this form is wholly unknown.

The condition of the blood causing purpuric manifestations always implies some kind of toxin as operative. In some forms the accompaniments partake of the infection by the *Diplococcus rheumaticus*, so called by Poynton and Paine in England and Triboulet in France. In many cases of purpura a preceding inflammation of the throat, quite similar to that described in our chapter on Rheumatic Fever, occurs both preceding and following the appearance of purpuric spots; so that there may be but little doubt of the affinity between these two affections. Many purpuric patients have the same forms of arthritis or joint affections as in true rheumatism, but rarely affecting the heart. It is curious, however, that in these patients the trouble almost always develops only on the lower extremities.

These rheumatoid forms, however, are not amenable to salicylates, notwithstanding their affinity to true rheumatism. This general toxin may have a number of cutaneous manifestations, the commonest being of urticarial nature. In fact, any affection characterized by subcutaneous hemorrhage implies a diseased condition of the walls of the blood-vessels, as well as changes in the blood itself. Hence we have cases in which the mucous membrane all over the body may show a tendency to bleeding, such as epistaxis or hematemesis, due to the mucous membrane of the stomach being involved. In other cases the affection develops in the bowels and causes diarrhea, not often bloody. These visceral developments in purpura are always serious, as they may involve the kidneys.

Treatment.—I would begin very early with administrations, in adults, of 15 gr. of calcium lactate four times a day; and in cases affecting the bowels I would add urotropin and sodium benzoate, 10 gr. each, four times a day. I have found the calcium lactate in doses of

15 gr. four times a day to be the most efficacious, but an emulsion of the oil of turpentine, in doses equivalent to 10 or 15 drops, often answers when other measures fail. In cases of purpuric hematuria the internal administration of adrenalin is the most efficacious, and if that does not succeed, then recourse should be had to serum treatment, as mentioned above.

HEMOGLOBINURIA

This disease consists in the passage of bloody looking urine, but blood-corpuscles are not found in the secretion, but instead of that the coloring-matter of the blood is generally diffused throughout the urine, and is not caused by any derangement in the kidney or urinary passages. The conclusion, therefore, is plain that it is due to an actual solution of the corpuscles in the blood itself, but the reasons for this are very obscure, for I have not found that these patients are usually anemic. The commonest form in my experience has been what is called paroxysmal hemoglobinuria, in which red urine is passed at different times during the day, oftenest in the morning. Such patients have come to me as women who in their daily tasks have been obliged to keep their hands in ice water, as in the preparation of vegetables or bunches of lettuce before sending them to market. Why the simple plunging of the hand into cold water should cause hemoglobinuria is difficult to explain, but it is ascribed by some writers as due to nervous spasm such as in Raynaud's disease. In Raynaud's disease spasmodic contraction of the arteries of the fingers occurs, so that it is sometimes called "dead fingers." I have also seen typical examples of dead fingers in hysteria, but what connection there can be between spasm of the arteries of the fingers and the production of hemoglobinuria I cannot imagine.

The treatment of my cases has been by the use of warm, instead of cold-water.

CYANOSIS

Some forms of derangements of the complexion resembling cyanosis are caused by analogous changes in the blood produced by drugs. One such drug which is less prescribed than formerly is sulphonal, and another important one in my experience was veronal. But we may have similar discolorations produced by disorders of the intestines, and which occur without being occasioned by drugs. Such cases should be treated at once by the administration of 10 gr. of urotropin with 10 gr. of sodium benzoate, four times a day, an hour after meals and at bedtime.

CHAPTER II

DISEASES OF THE CIRCULATORY APPARATUS

EXAMINATION OF THE BLOOD-VESSELS

BEFORE examination of the pulse and of the heart itself, the actual physical conditions of the circulatory apparatus should be carefully noted, including examination of the arteries, of the veins, of the capillaries, and of the interstitial circulation outside of the capillaries. Important practical information is thus often gained about states of function or of nutrition, both local and general, which will materially assist in the interpretation of all other circulatory symptoms. Both the beats of the pulse and the action of the heart are constantly affected by conditions existing not only in the blood-vessels proper, but in that important part of the circulation to which everything else is subsidiary, namely, the rapidly moving fluids which bathe the cells of the tissues.

A perfectly healthy radial artery is impalpable, and can be located only by its beat. Such arteries found in a man fifty years old imply that he belongs to a long-lived family; that he has no kidney disease, nor gout, nor lead-poisoning, nor emphysema, and it is unlikely that he has any serious heart disease. But long before fifty many persons are found with their radials as palpable as the tendons between which they lie, or they can be rolled under the finger like cords. Such arteries are diseased from chronic blood-poisoning of some form, leading to obstruction of their outflow into the capillaries, and the first thing to determine is to what extent the vessel wall has consequently become thickened or changed. It may be only thickened by hypertrophy of its muscular coat, secondary to the work entailed to overcome the obstruction, and which thickening is removable by cessation of its cause. If such be the case, the artery feels smooth and uniform, and by placing three fingers along its course, on pressing with the first finger above enough to stop the blood flow, the other two fingers can hardly feel the collapsed vessel in its bed. If, on the other hand, the emptied part of the vessel still remains plainly palpable, it then is more than simply thickened or overfull, because its walls have become altered into more or less inelastic tubes. Local atheromatous

and sclerotic changes in the vessel walls make it feel no longer smooth or uniform, but often so uneven as to resemble a string of beads. As we shall see, atheroma always implies pre-existing strain, and is especially present in arteries at the seat of most strain. Another evidence of obstruction in front is that the vessel becomes tortuous. A temporal artery coursing up a bald head like a corkscrew is not a sign of good import. The presumption raised by such conditions in the larger vessels is that vast numbers of the arterioles over the body have become obliterated, a surmise which is confirmed by inspection of the preternaturally white abdomen on which the finger nail may be sharply drawn without producing more than the most transient red mark on the anemic skin.

The skin anemic from other causes than this arterial ischemia—*e. g.*, febrile anemia—is easily reddened by friction. Some form of malnutrition, therefore, is present everywhere in such a body, and is to be taken account of whenever a part is specially attacked by acute disease. Thus the prognosis of a pneumonia or of a typhoid fever is not so favorable with coexisting general arterial degeneration, while both cerebral and spinal affections will have more serious import.

One inference from these signs of general arterial disease is that the increased work by the heart to carry on the circulation through such altered vessels will lead to its hypertrophy and ultimately to its dilatation. On the other hand, marked hypertrophy of the heart and dilatation may occur with but moderate atheromatous changes in the arteries, and, *vice versa*, extensive atheromatous changes may be found, especially in the aged, without cardiac hypertrophy.

Some writers (Schmaus) have tried to explain these facts by assuming that only extensive atheromatous changes in the abdominal arteries will suffice to produce cardiac hypertrophy, but this statement still lacks proof. Atheromatous patches are always more or less local in their distribution, and some obstruction more general than anything simply local seems called for to explain the effects upon the heart.

Now, it has been demonstrated that the internal secretion of the adrenal glands is essential to life, owing to its property of toning up the entire arterial system. A very slight excess, therefore, of this secretion in the blood will cause such universal arterial contraction that it will entail more labor on the heart than any local atheromatous changes, however extensive (as will be noted in the chapters on Nephritis).

Marked atheromatous changes in the aorta and larger vessels have been caused experimentally in rabbits, dogs, and cats—animals not

prone to such arterial disease—by long-continued administration of adrenalin, evidently from the strain produced by this artificial hypertension of the arterial flow. The presence of excess of adrenalin also explains the initial tension and overfilling of the arteries in recent kidney disease better than the theory of vasomotor spasm, as this can hardly be as continuous or universal as the condition found in the systemic circulation in such cases.

It may readily be inferred that persons with a diseased arterial system are liable to aneurysmal dilatation and to rupture of these vessels. A patient, therefore, who, after a sudden attack of hemiplegia, shows no palpable changes in his arteries, should suggest embolism or syphilis rather than cerebral hemorrhage as a cause of his symptoms.

Arterial changes of this kind are incident to old age as such, but there is a wide range of years between individuals in this respect. A proneness to apoplexy or to other accidents due to diseased vessels is often a family trait, and has suggested the statement that a man is as old as his arteries.

Another condition to be noted in the arterial system is throbbing, by which is meant undue visible or palpable pulsation. This may be either local or general. One form of widely distributed pulsation is owing to regurgitation through the aortic valves, and the best locality to observe it is at the bend of the elbow, when, on flexing the joint, the brachial artery can be seen to throb both above and below the joint in a fashion which is pathognomonic of this cardiac lesion, and hence is confirmatory of the auscultatory signs. In old people a moderate degree of throbbing may be observed in all the large arteries. In younger persons pulsation of the arteries of the neck is suggestive of cardiac valvular disease, but may be quite pronounced in anemic patients, particularly under emotion, without any valvular lesion. Pulsation in the subclavian artery may be a valuable sign of disease, with shrinkage of the apex of a lung drawing upon the artery by pleuritic adhesions. Such a lung change may even make the pulsation of the arch of the aorta visible. Pulsation visible on the surface of the chest, away from the normal limits of the pericardium, should always suggest aneurysm as the cause, except in the case of a pulsating empyema. This may be distinguished by its greater distance from the median line than aneurysm, and by its being usually on the left side, with extensive dulness on percussion at the base of the lung.

It is in the abdominal cavity, however, that abnormal pulsations abound fully ten times as often as in the thorax. They may occasion

such distress as to interfere with sleep, while the throbbing may be so situated as very naturally to suggest aneurysm. But mistaken diagnoses about abdominal aneurysms are the rule, because not only are none present in the great majority of cases, when so supposed, but Bryant¹ states that at Guy's Hospital, out of 54 cases of abdominal aneurysm, only 18 were correctly diagnosed during life by its able staff. Hence, it is serviceable to note that an abdominal aneurysm is relatively not a common affection, the average incidence being 10 in the thorax to 1 in the abdomen, while in women abdominal aneurysms are extremely rare. Abdominal pulsation, on the contrary, is much more common in women than in men.

One form of such pulsation, which may be very strong and plainly visible in the epigastrium, is caused by transmission, through the left lobe of the liver, of the impulse of a dilated right ventricle, but sometimes a greatly dilated right ventricle will itself lift the ensiform cartilage and the skin over it into the semblance of a pulsating tumor.

The toxemia which causes hysteria often selects the vasoconstrictors of the great splanchnic arteries to produce in them local paralysis or local spasm. One effect of such paralysis is the supervention of polyuria. I had a patient who every morning for two years passed, with a sense of much internal throbbing, 100 ounces or more of colorless urine, sometimes with the specific gravity of spring water, to be followed in the evening with a few ounces of urine perfectly normal in color and in specific gravity. In other cases spasm causes anuria instead of polyuria. Such patients are called neurotic erroneously, for the nervous system is not at fault in them any more than it is in a drunkard, but their blood poisons not only cause a great variety of nervous symptoms, but sometimes the abdominal aorta in them may be felt pulsating most violently with both a thrill and a bruit.

Inflammatory or ulcerative conditions in the mucous membrane of the gastro-intestinal tract are always accompanied by arterial throbbing in the regions affected. In suspected gastric ulcer, pulsation should be looked for, though, if found, its locality may not closely correspond to the seat of the lesion in the stomach. In some forms of cancer of the stomach, especially in the large flat variety, pulsation is often very pronounced. In acute enteritis the pulsation is quite pronounced, usually at the left of the umbilicus, and always to be found in acute colitis, and is then most commonly due to throbbing of the mesenteric arteries.

One of the commonest causes of widespread arterial pulsation is a

¹ Clinical Journal, 1903.

watery state of the blood; hence we find it in most forms of anemia, where pulsation may be present not only in the arteries, but also in the large veins. Sudden hemorrhage in the abdominal cavity is sometimes the cause of the most extraordinary throbbing. Osler¹ reports a case of a large, stout man, aged forty-five years, who when seen by him was anemic, and looked as if he had had a recent hemorrhage. His large and fat abdomen throbbed in a most extraordinary way. The shock was communicated to the patient's body, and one could plainly see the jar in the head and in the feet. Standing against the foot of the bed, Dr. Osler could feel distinctly the impulse jarring the entire bed. That evening the cause of the sudden anemia became evident as he passed a large amount of blood by the bowel and vomited blood. The necropsy showed a duodenal ulcer lying directly upon the pancreas and the aorta. The aorta itself was perfectly normal.

In Graves' disease arterial pulsation is visible, not only in the arteries of the neck, but sometimes in all the arteries that can be seen, as we might expect from the specific effect of the toxin of this disease in producing paralysis of the vasoconstrictors. Some of the greatest difficulties in diagnoses of the cause of abdominal pulsation are due to transmission of the arterial throb through tumors, such as cysts or solid tumors of the pancreas, mesentery, and retroperitoneal glands. When these tumors form attachments to the arteries, differential diagnosis from an aneurysm may be impossible, because they may have a distinct bruit, and it is not always easy to determine in abdominal tumors whether they are expansile or not.

Veins.—The veins of the backs of the hands most readily afford evidence of general conditions affecting the venous flow. These may be habitually distended in states of muscular or nervous debility, especially when the hands hang down. It is in gouty states of the blood, however, that this sign is most useful. For example, when in doubt whether an arthritis be gouty or rheumatic, it is not rheumatic if the veins about the joint are distended, as well as the veins on the backs of the hands. This sign in the hands may also be confirmatory of other signs of lead-poisoning, as a gouty condition of the system is then very common. Enlargement of the veins about any diseased joint rules out rheumatism, for however chronic a rheumatic inflammation be it does not distend veins.

Localized phlebitis may often be recognized in typhoid fever, when it most commonly affects the saphenous vein near the groin. The vein then becomes hardened and very tender to pressure. If seen early, the

¹ Lecture on Aneurysm of the Abdominal Aorta, *Lancet*, October 14, 1905.

phlebitis may be arrested by painting the track of the vein with strong tincture of iodine. It is in chlorosis, however, that such localized phlebitis may occur successively in widely distributed localities.

Otherwise, enlargement of the veins has a local origin and may be of great value in diagnosis of the particular organ or structure which is affected. In some instances the signs of the venous obstruction indicate just what has happened, if not also the nature of the disease which causes the engorgement.

Varicose veins of the leg imply nothing but a local abnormality, generally owing to congenital developmental defects in the venous valves analogous to those defects in the inguinal canal which lead to hernia. They are, therefore, often family complaints, but may secondarily arise from too prolonged standing, just as hernia may first occur after strain of the abdominal muscles. The branches of the internal saphenous vein are the oftener affected, and appear most on the inner aspect of the calf. Much less commonly the external saphena is involved, appearing on the outer side and posteriorly. The strain of the unsupported column of blood produces the same effects as strain in arteries, for the walls of the veins become thickened and atheromatous, and even calcified; but the significance of this vascular change wholly differs in the two cases, for a thickened artery implies general arterial disease and not, like varicose veins, limited to the legs. Hence, the indication for treatment of varicose veins is to furnish external support by bandages or elastic stockings. Care should be taken, however, not to confound with this trouble the very different condition of the venous circulation of a leg in which the deep femoral veins or *venæ comites* have been obstructed. This occurs in the *phlegmasia alba dolens* or milk leg of parturient women, in whom it may be for years after their recovery that the affected leg remains heavy, swollen, and stiff. In them the surface veins become enlarged compensatory to the obliteration of the deeper veins, but their appearance differs from varicose veins in being smaller, and with stellate radiations under the skin from the larger vessels. In such patients tight bandaging, by interfering with the collateral circulation, increases the pain in the leg.

It is, however, in disease or tumors involving important organs in the great cavities of the abdomen and thorax that enlargement of the surface veins most commonly afford evidence of the internal mischief. Thus, the most pronounced appearances of enlarged and tortuous veins on the surface of the abdomen are to be seen when cancers or sarcomatous tumors of the liver, pancreas, or kidney encroach upon the

ascending vena cava. But it is in cirrhosis of the liver that we most often find compensatory enlargement of the surface veins, though not so tortuous as in the last case. One set of these veins belong to the accessory portal system of Sappey, whose branches pass in the round and suspensory ligaments and unite with the epigastric and mammary systems. Occasionally, one finds a large single vein of this system joining the epigastric veins at the navel, having followed the situation of the obliterated umbilical vein. This produces about the navel a bunch of varices, the so-called *caput medusæ*. Another communication occurs between the hemorrhoidal and inferior mesenteric veins, when they become merged with a larger flow, distending the veins of the surface on account of the pressure of ascites interfering with the flow of venous blood, from the lower extremities through the iliac veins. This causes the veins to appear as if ascending from the neighborhood of Poupart's ligament, the blood then taking its course through the inferior and superior epigastric veins to the mammary veins.

But it is organic, changes occurring in the thorax which produce the most pronounced and distinctive derangements of the venous circulation. This is particularly the case when the primary seat of the disorder lies in that space between the two lungs, called the mediastinum. So many vital organs are packed together in that space behind the sternum that it is well for every one to be able to enumerate them. Setting aside the heart and pericardium, we have what remains of the thymus gland: the arch of the aorta and its descending portion, with the innominate and commencement of the left carotid and subclavian arteries; the superior vena cava, innominate, and azygos veins, and the termination of the inferior vena cava within the pericardium before it enters the right auricle; the pulmonary vessels; the trachea and its bifurcation with the main bronchi; the pneumogastric nerves, with the left recurrent laryngeal and cardiac branches, phrenic and splanchnic nerves, and the cardiac plexuses; the roots of the lungs, including the pulmonary vessels and bronchi with their primary divisions, and the anterior and posterior pulmonary plexuses; the esophagus; the thoracic duct, and whole sets of particular lymphatic glands. Between all these parts there is a packing of loose cellular tissue, which may also share in the production of derangements. On that account, one of the commonest accompaniments of new growths in the mediastinum is the appearance of many enlarged and tortuous veins on the surface of the chest.

As the mediastinum is not a viscus, it is scarcely correct to speak of a mediastinitis, except with a limitation sanctioned by usage of the

term to inflammation of the mesh of connective tissue between the various organs. This may be due to an extension from an inflamed pericardium; but also the pleural surfaces, a reflection of which surfaces bound this space on each side back to the roots of the lungs, may participate in the process. Sometimes in chronic mediastinitis all the contained organs are found at autopsies so matted together that they cannot be separated, and have to be removed *en masse*. It can readily be inferred that in such cases before death all the veins forming branches of the descending cava are enlarged, with occasionally, as I have seen, enlargement of the surface abdominal veins, with ascites from implication of the ascending cava as it enters the pericardium.

Mediastinal tumors, whether aneurysmal or malignant, may cause the same appearances of venous engorgement. When the superior vena cava is affected, the whole head, face, ears, neck, and both arms become swollen. On the surface of the chest the mammary and superior epigastric veins are enlarged and very tortuous-like varices. The intercostal and subcutaneous veins near the spine may also be dilated, which is suggestive of occlusion of the vena azygos.

This appearance of the veins, however, occurs usually earlier, and is more pronounced with malignant growths than in aneurysms or other intrathoracic tumors, so as to be of some use in diagnosis, probably because aneurysms simply push aside contiguous structures, while malignant growths directly attack and invade them.

Much the commonest cause, however, of visible enlargement of veins is organic change in the right heart, when, though the surface veins of the chest are not much altered, the veins of the neck and head are so characteristically affected as to merit close observation. Occasionally the heart is dilated by external traction upon it by pericardial adhesions to contiguous structures. But the commonest cause of venous engorgement occurs in the pulmonary circulation, which may be primary, as in emphysema, or secondary, to mitral valve disease of the left heart, particularly mitral stenosis. The right heart, accordingly, first hypertrophies and then dilates, until the tricuspid valves become so incompetent that backward regurgitation occurs with each systole into both the ascending and descending cava. This causes a true pulsation to be visible in the veins of the neck, particularly in the right internal jugular, as this vessel descends in a direct line to the innominate vein. Therefore a visible pulsation in the veins of the neck is a sure sign that the right heart no longer effectively forwards the blood through the lungs. Occasionally, instead of pulsa-

tion above in the neck, a pulsating tumor like a ball is seen at the junction of the jugular and subclavian veins. This happens when the valves in both the jugular and subclavian veins are competent enough to prevent further regurgitation from the right heart.

DISEASES OF THE CAPILLARIES

The most important parts of the circulation are those tubes which intervene between the ends of the arteries and the beginning of the veins, and which, from their small size, are called capillaries. It is through them that the interchange occurs both of the fluids and of the gases like oxygen, which nourishes the tissues and the materials that are returned to the circulation of the same regions. As a rule, the capillaries are of the same diameter, but the interspaces between them vary according to the vascularity of the part. Sometimes the interspaces are actually smaller than the diameter of the capillaries, but in known vascular parts they may be a good deal larger. In structure they consist of a layer of epithelioid cells, usually placed end to end, and which may be considered a prolongation of the intima of the smallest arteries. These cells are bound together by a cement-like substance. The walls of the capillaries are so thin that they allow an easy passage through them of nutrient fluids, and also of fluids containing the used-up materials of the tissues. They also allow in certain regions the white corpuscles to pass through the walls in both ways. It is evident from what has preceded that the process of arteriosclerosis, above described, also extends into the domain of the capillaries, causing widespread obliteration, a change never absent in general arteriosclerosis, which, as we have remarked, at any time may be demonstrated in the skin of the abdomen by drawing the finger-nail over it. In young and normal tissues this procedure readily leaves a red mark, as we have described, which is absent in all conditions of vascular sclerosis.

THE PULSE

Every physician is as much accustomed to feel the pulse as to look at the tongue, but both these procedures may be performed in a wholly routine manner without much thought accompanying it. To prevent this, we would here briefly indicate what should be carefully observed in every examination of the pulse.

For ordinary purposes six elements should be noted in the pulse, three of them being exclusively caused by the action of the heart and three of them by the condition of the artery. The first cardiac

element is frequency, for, whether the pulse be rapid or slow, it is caused by the rapid or slow contraction of the left ventricle; the second cardiac element is strength, for that depends upon the ventricle beating strongly or feebly; the third is rhythm, that is, whether the heart is beating regularly or irregularly. The first vascular or arterial element is size, or whether the pulse feels full or small; the second vascular element is quality, that is, whether the pulse is hard or soft, ordinarily termed "incompressible" or "compressible"; the third vascular element is duration, that is, whether the pulse-wave passes quickly under the finger or is more or less prolonged, commonly denoted as a short or long pulse.

These are elements which every physician should learn to distinguish by his own practised sense of touch. Among these characters of the pulse, which are recognized by the sense of touch, is one that is always of pathologic import, namely, dichrotic pulse, commonly found in the early stages of typhoid fever. To the observer it feels as if he had two pulses, the first and the stronger wave being the ordinary systolic pulse, caused by the contraction of the left ventricle. This is immediately followed by a feebler wave, which is due to a reflux from the periphery.

As to frequency, it may mean only nervous excitement, in which case it soon subsides; it may mean the presence of fever; in all fevers, if they be prolonged, the pulse is apt to be much increased in frequency, as in phthisis; or, it may be due to exhaustion; thus in a convalescent from typhoid fever the pulse may be slow while the patient is recumbent, but quickly rises in frequency if the patient sits up. It is then important to note how much the change of posture has increased the frequency, for in health this change of posture should only increase the pulse-rate from 5 to 15 beats. But if, instead, it increases it from 20 to 40 beats the patient should not yet be allowed to sit up, for fatal syncope has often followed from neglect of this precaution. A frequent pulse, however, may occur in other conditions, as in Graves' disease and in tabes, but in neither of these states is the rate of the pulse altered by change of posture.

As to strength, this is ordinarily increased in the first stage of all acute inflammations, such as pneumonia, and, besides the pulse, the force of the impulse of the heart against the chest wall should be noted; when, instead, the pulse is weak, the causes of its weakness should be carefully determined. And here, again, in pronounced cases the heart impulse may be scarcely perceptible; the weakness may be due to debility of the heart wall, the causes of which should be clearly dis-

tinguished; the pulse may be fairly strong, but the impulse be absent in cases of emphysema; the impulse may be weak and yet diffused in cases of dilatation; or the heart may be weak from exhaustion in cases of prolonged fever, each of which conditions may require special treatment.

As to rhythm, a distinction should be made between an intermittent and an irregular pulse; an irregular pulse is always a sign of disease, while an intermittent pulse may coincide with good health. I have known persons in excellent health, who presented a regularly intermittent pulse, dropping every fourth or fifth beat; or an intermittent pulse may be caused by too free indulgence in tea or tobacco, as well as by some medicines, of which digitalis is an example. In the case of digitalis the supervention of an intermittent pulse should lead to cessation of its administration, for it may cause severe vomiting and collapse, which may be relieved by a full dose of opium. An irregular pulse, on the other hand, is characterized by derangement both of frequency of rhythm and of size, and is present in conditions of dangerous exhaustion or of actual heart disease.

As to its vascular elements, the pulse is full and large in the first stages of all inflammations excepting peritonitis. It is small in anemia, excepting chlorosis; in all conditions of weakness, such as the later stages of prolonged fevers. In scarlet fever the pulse is strikingly small and of high tension from the beginning.

Between these different characters of the pulse, relatively, the most important is its tension. We have already, in speaking of arteriosclerosis, shown the great significance of the pulse with permanent high tension. The degree of this tension the finger alone cannot accurately determine, and so a number of different sphygmomanometers have been devised, which need not be enumerated here. To become really adept in their use requires much practice, and, therefore, when in doubt, I am accustomed to refer many cases to the reports of an expert.

As to duration, the pulse is long in all cases of high tension, and is characteristically short in some inflammations, notably in cystitis, when this character of the pulse may be diagnostic.

Stokes-Adams' Disease, or Heart-block.—The impulse causing the heart to beat originates at the venous end of the heart, and is transmitted in such a way that the auricles contract first, the ventricles a moment later, the impulse being propagated like a peristaltic wave through the heart walls. "This is by means of a muscular strand; in the adult heart this auriculoventricular bundle of His, as it is called,

arises in the septum of the auricles below the foramen ovale, and passes downward through the trigonum fibrosum of the auriculoventricular junction, where it comes into close relation with the mesial leaflet of the tricuspid valve" (Osler). Recent researches show that its fibers extend even to the apex of the heart. Disease or atrophy of this bundle of His prevents the contraction of the auricle from being continued to the ventricle, and the ventricle then contracts and relaxes independently, with the slowing of the pulse at the wrist. I had a patient in whom I never could succeed in increasing his pulse-beat above 36, while usually it remained about 30. His symptoms were very characteristic of this condition. He had frequent epileptiform attacks, when he would fall to the ground with a transient loss of consciousness. Under treatment by grain doses of powdered squills with $\frac{1}{80}$ gr. of strychnin, he recovered from these attacks and was able to resume his business, but I never succeeded in causing the ventricle to contract as rapidly as his auricle. Cases much resembling Stokes-Adams' disease in effect on the pulse sometimes occur in elderly people with general arterial disease, that is, they have attacks of unconsciousness with epileptiform twitchings, but are soon relieved by squills, strychnin, sodium iodid, and my tonic prescription of iron and carbonate of ammonia. (See page 290.) In all cases of slow pulse the frequency of the beats of the heart with the radial pulse should be noted, because it may be that the systole of the ventricle is not strong enough to reach the wrist.

ARTERIOSCLEROSIS

"The blood thereof which is the life thereof" is a statement very fully illustrated by the pathology of any part of the body the supply of whose blood is interfered with by a diseased condition of its blood-vessels. The first result of such interference is a loss of vitality in the part, directly proportional to the degree of this interference. If it be complete, necrosis or gangrene forthwith follows, but if partial, then vitality continues, but lessens in simple proportion to the interference with the circulation. Old age is a natural disease of our race, and its pathology is almost wholly that of aging of the blood-vessels, because that induces senility of all the muscles, causing them to atrophy and to become stiff; likewise, senility of the glands and general senility of nutrition, shown in the wrinkled skin and whitened hair.

But the process of growing old varies greatly in different individuals. Nowhere is the jocose advice so applicable that one should be particular in the choice of his parents, because the life of the arteries depends

first on heredity. Some persons' arteries are as old at forty as those of others at threescore years and ten. The chief aim of a physician, therefore, is not to prevent the inevitable ending in death, but to postpone it, and for that we should study what parts of the vascular apparatus are diseased.

Arterial Structure.—Preliminary to the consideration of the different forms of arterial disease we should have a clear picture of the structure of these blood-vessels. An artery is composed of three coats, the inner one, or the intima, lining the whole vessel, from its beginning in the aorta to its finest divisions of the arterial tree. This intima in health is smooth, composed first of an epithelial lining of polygonal or fusiform cells. Under the epithelium are layers of delicate elastic tissue, which increase with the size of the artery until they form the greater part of the intima in the aorta. The intima is subject to changes when the artery becomes diseased. One change, which is rather compensatory than otherwise, is described by Thoma as the deposition of a hyaline material noticeable in the lining of the larger arteries. He, by injecting the aorta and large arteries with paraffin wax at a pressure of 160 mm. of mercury (the mean pressure in the aorta), has shown that the paraffin casts are quite smooth, and present none of the irregularities which the nodular plaques would have produced had they not exactly filled up the bulge in the vessel wall, produced by the weakened media, at the spots where the intima is thickened. Certainly, this is a strong argument in favor of his compensatory view.

But aside from that, changes occur in the intima which are undoubtedly pathologic. These are the first patches, which look almost like simple depositions in the walls of the intima, with a pale yellowish color. In time these increase in thickness as well as in extent, and undergo a species of fatty degeneration called atheroma, notably in the aorta and larger branches. In these atheromatous patches there may further occur extensive deposits of lime salts, or the condition called calcification. Besides this, longitudinal slits may occur in the intima, some of which terminate in ulcerative processes that involve the other coats, thus leading to aneurysms that may be of small size, but, nevertheless, very serious if they occur in the cerebral arteries, as they then occasion attacks of cerebral hemorrhage. Such arterial changes may be very extensive, involving the smaller arteries, and thus constituting the first stage in the widespread disease called arteriosclerosis. This condition has been well defined by F. W. Mott as "a local or general thickening of the arterial wall with loss of contractility and elas-

ticity occasioned by fibrous overgrowths, mainly of the tunica intima, secondary and proportional to degeneration of the muscular and elastic elements of the media."

The most living part of an artery is the middle coat, as it contains a muscular layer whose cells are in connection with a very peculiar, but most important, division of the nervous system, called the vasomotor nerves. The fibers of the middle coat are transverse instead of longitudinal, as in the intima. It is composed of two layers, the first of which is the elastic tissue, which wholly predominates in the aorta and the larger arteries, and the second is the muscular layer, which is of a different and reddish color. This muscular layer proportionately increases from the medium to the smaller arteries until, in the smallest arteries, it constitutes the chief elements in the walls of the vessels.

The adventitia, or outer coat, is made up by a condensation of connective tissue mingled with layers of elastic fibers. The vasomotor nerves form a dense plexus upon the coats of the medium-sized arteries, and then accompany these vessels down to the smallest of them, which, however, may have but a single nerve-filament. The function of these vasomotor nerves is to regulate the distribution of blood both by contracting and by dilating the arteries, according to the needs of the part. Like other branches of the sympathetic, the vasomotor nerves form small ganglia, situated generally at the bifurcation of the arteries. At the other end of this system there is what is called the vasomotor center, in the medulla oblongata. One important fact, however, should be mentioned, that the vasomotor nerves depend for their activity upon the presence in the blood of a secretion of the adrenal glands, called adrenalin. When these glands are excised, death rapidly follows from a total loss on the part of the vasomotor nerves to act according to their proper functions. Absence of adrenalin in the blood from disease of the glands causes that malady to be hereafter described as Addison's disease, but there can be no doubt that the adrenals are also capable of excessive secretion, which, by unduly contracting the arteries, leads to high pressure or strain in the circulation, and hence must be one cause of arterial disease. Atheromatous and degenerative changes in the coats of the arteries are dependent entirely upon the amount of local strain. It is a very curious fact that originally the adrenal glands are derived from a branch of the sympathetic, which becomes rolled on itself like a ball of twine, and then, breaking away from its parent stem, it takes on a capsule, and thus becomes the adrenal gland, to be situated upon the upper extrem-

ity of the kidney, with which, however, it has no anatomic connection. Arteriosclerosis, as a general morbid process, was first described by Gull and Sutton, who extended this morbid change from the arteries into the domain of the capillaries. Arterial disease presents numerous features, many of which are not yet wholly solved.

Etiology.—As to etiology, heredity ranks first, as previously remarked. The consequent changes, however, differ according to the nature of the tissue. Thus, brain tissue can continue to perform its mental functions years after the arteries of the body have become aged. Gladstone delivered one of his greatest speeches when he was eighty-six years old. The nervous system, being the royal tissue, will have its blood, no matter what happens to other textures.

As already remarked, the coats of the aorta and of the larger arteries are pretty sure to show the beginning of atheromatous changes and sclerotic changes in middle life, and these go on increasing with the years until arteriosclerosis is present throughout all of the smaller blood-vessels. The vulnerability of the arterial tissue to strain is not surprising, considering that not only does a ceaseless rush of fluid pass through them at a speed of 10 inches a second, but the walls of the main pipe are subjected to a distending force of $2\frac{1}{2}$ pounds to the square inch 60 to 80 times a minute, 80,000 to 100,000 times in the twenty-four hours.

The special morbid process begins in the intima and then involves more or less the other coats. The changes commence in the intima, and may be so pronounced as actually to obliterate the lumen of the vessel, but usually the middle coat is also involved, some writers maintaining that the muscular layer is hypertrophied and the elastic fibers increased, but these changes in the middle coat doubtless vary with different individuals and at different times, because in some patients the symptoms of spasm come and go, which, of course, indicate the participation of the muscular coat in their production. One evidence of this is consequent high pressure of the pulse, producing increased strain on the walls of the vessel, but strain, in turn, is very apt to lead to atheromatous degeneration, as we find this latter condition most pronounced in those regions of the vessel which are subject to the greatest strain. This is particularly the case in the high tension which characterizes chronic interstitial nephritis. But that kidney disease is not the only cause of either atheroma or high tension is shown in a number of cases characterized by extensive atheromatous changes in the arteries, and yet in whom there is neither high pressure nor interstitial nephritis.

Strain in the circulation must also vary greatly in different persons, particularly in those who are subject to extreme variations in the activities of modern civilization. When we consider not only how changes in the rapidity and force of the blood-stream must produce their effects, we have also to take into account no less important factors depending upon the composition of the blood itself, as these may be affected by the derangements of the excreting glands. All this goes to prove how very complex the problems of vascular derangements must be. A good indication of the general state of the circulation is afforded by the capillary circulation of the skin. If the smaller arteries are permeable and the blood-supply to the skin normal, drawing the back of the nail over the skin is at once followed by a red mark. If, as is strikingly illustrated in chronic interstitial nephritis, the cutaneous circulation is poor, this procedure hardly produces any effect. This is notably the case in the loose skin of the abdomen, particularly in cases of cirrhosis of the liver, in which it may be quite difficult to produce any red streak in the skin, however actively the finger-nail is drawn across it. Persons in such conditions are very prone to be carried off by pulmonary edema in pneumonia. They are also pretty sure to have pulmonary emphysema; as surgeons well know they bear operations badly.

Arteriosclerosis implies obstruction caused by roughening of the lumen of the lining of the vessel, whether by atheroma or by calcareous deposits. This leads to tortuosity of the surface arteries, often very strikingly shown in the crooked temporal arteries, which may be visible across the room.

Besides the structural changes in the walls of the arteries, the diseased arteries are themselves prone to spasm of their muscular coats, which often is quite local. Such angiospasm, as it is called, may temporarily occur in widely distributed parts of the body, causing symptoms whose significance every physician should know, as they constitute danger-signals. Thus, as shutting off of arterial blood always causes cramp of the muscles supplied by that artery, so cramp in the calf of the leg occurring in elderly people is a precursor of apoplexy due to angiospasm in the cerebral arteries. Analogous angiospasm in the cerebral arteries may cause transient attacks of giddiness or vertigo, or likewise temporary aphasia. It is high time, then, for the use of the sphygmograph to determine the presence or not of high blood-pressure. These facts, which we have been reviewing, are practically of great importance in the prophylaxis or prevention of serious calamities. Thus, as we have before remarked, nerve tissue

is not at fault when a person is paralyzed by an attack of apoplexy or of hemiplegia. It is, then, not nerve tissue, but arterial tissue which is diseased, and instead of considering the brain we should most likely turn our attention to the kidneys as the true source of the whole trouble.

Treatment.—The existence of widespread arteriosclerosis is always of serious import, but the outlook is by no means hopeless. We are always provided with an oversupply of what we need for life, thus we have two kidneys, when any one may get along very well for years with only one kidney. Likewise, everything necessary for life in our arteries is much in excess of what is needed. This we will now demonstrate as we show what we should do in the treatment for cases of widespread arteriosclerosis with high blood-pressure. As these patients commonly have shrunken kidneys from chronic interstitial nephritis, the kidneys should be spared as much as possible in their work. That work is not increased by a diet of carbohydrates, such as in starches and sugars of vegetables and fruits; but the work of the kidneys is very greatly increased when they have to deal with the nitrogenous elements of the food, in other words, with meats. Meat of all kinds, therefore, should be sparingly used, or altogether avoided, especially at the evening meals. As the body must have nitrogenous food, this can be best supplied by the various preparations of fermented milk, previously explained in the article on such a spasmodic disease as epilepsy.

Medicinally, we have extremely valuable agents, which act as vasodilators. Of these the nitrites, such as nitroglycerin and its allies, are well known, and are frequently employed for this purpose. But the disadvantage of all nitrites is that their action is very evanescent. I have, therefore, regarded it as an important fact to be widely known that we possess in aconite a more efficient and permanently beneficial vasodilator. The only agent which approaches aconite for this purpose is *veratrum viride*. The official tincture of aconite of the Pharmacopœia of 1890 should be prescribed in full doses, namely, 10 drops four times a day, and continued, it may be, for years. It is unfortunate that the revisers of the Pharmacopœia are not themselves physicians, for their present composition of the tincture of aconite is almost inert, being only one-fourth as strong as that of 1890. There need be no fear of the primary depression of the heart in healthy persons by aconite, because the relief of the heart by dilatation of the arteries quickly overbalances any primary depression in these patients. One of the most indisputable proofs of this statement is shown by the

prompt increase in the elimination of urea by kidneys contracted in interstitial nephritis. I have shown in several published articles that in cases of undoubted shrunken kidney, accompanied with all their characteristic symptoms, the excretion of urea has by the administration of aconite been doubled or trebled, and, in a few cases, quadrupled. This has been my experience both in hospital and in private practice for many years, and without any ill effects whatever. For example, I have published a case which I saw in consultation with Dr. Travis, of New York, of a lady aged sixty-five, who could not be turned in bed without losing color in the lips from heart failure, who was immediately and permanently relieved by the above doses of tincture of aconite, simply because her exhausted heart was by the aconite set free from contending with general arterial contraction.

Now, increased elimination of urea found by examination of the urine cannot possibly be a matter of theory, and the restoration of the normal functions of the kidneys, so far as possible, is the first indication in the treatment of chronic interstitial nephritis. But imperfect elimination in such a chronic affection as interstitial nephritis may be very generally observed in patients who go about their business without knowing that they are seriously diseased until a sudden explosion of symptoms of uremia terminates the story.

I therefore found the administration of aconite invaluable as a prophylactic. What we would particularly allude to here is the curative property of aconite in that sad mental derangement melancholia, which is characterized by a high blood-pressure, as the following history illustrates: A patient of mine had been gradually passing into this state with hallucinations about being financially ruined until he became maniacally insane, and repeatedly tried to break through the windows. Dr. J. Edgar Welch was obliged to employ three men to hold him while he was taking his blood-pressure. By my direction the doctor gave him 15 drops of the 10 per cent. tincture of aconite every half-hour until he had taken six of these doses before he became quiet. After this he remained permanently better, and in a few weeks was able to resume business, meantime taking 15 drops of the 10 per cent. tincture of aconite¹ four times a day to prevent a relapse.

A few years ago I was asked by a gentleman to prescribe for his widowed sister without seeing her, because in her then condition she refused to see any physician or to take any medicine. His story was that she had been subject to severe melancholia until she became maniacal, and had to be committed to an asylum, where she remained

¹ Pharmacopœia of 1890.

for about six months. She was then allowed to go home, where she stayed for nearly two years, attended by a trained nurse, but, as above mentioned, in strict seclusion. Without seeing her, I prescribed aconite to be given by her nurse before each meal without the patient's knowledge. She at once began to improve in her mental state, taking four doses of the tincture of aconite during the day. After this she wholly recovered and began to gain flesh, remaining in excellent health and spirits until her death, which is thus detailed by her brother in a letter to me:

"My sister passed away in her sleep Saturday morning, May 3d. She owed to you five years of health and happiness, and I owe you a debt of gratitude which no words can describe. It seems to me in the interest of humanity your treatment with aconite ought to be more widely known, particularly in asylums."

The only other agent which I would mention for the treatment of arteriosclerosis is corrosive sublimate, given in doses of $\frac{1}{8}$ gr. three times a day, along with the aconite, for I have known this agent also to increase the elimination of urea.

Moreover, it can be conjoined with 5 gr. of the sodium iodid, three times a day, given before meals. The functions of the skin should also be carefully attended to in the management of these cases. It is well known how the skin supplements the work of the kidneys, for free perspiration in warm weather invariably lessens the output of water by the kidneys. These patients, therefore, do better in summer than in winter, particularly as in summer they can further add the general dilatation of the cutaneous circulation, which, instead, is contracted during cold weather. On that account many of these patients when they can afford it do better if the winter be spent in warmer climates. Speaking generally, careful protection of the skin by warmer clothing is indicated in the cases of all patients who suffer from arteriosclerosis.

ANEURYSM

In the healthy human body there is no room for anything but its normal organs and tissues, hence the importance of anatomy, because by its correct knowledge we can at once detect what ought not to be there. This is well illustrated in the case of aneurysms, which cause swellings in the course of arteries quite distinct from growths, and yet which clinically may produce symptoms scarcely distinguishable from them. In discussing the causes of apoplexy and of hemiplegia we mentioned an important variety of aneurysms which, though so small that they are called miliary aneurysms, are, nevertheless, as truly aneurysms as those which form great tumors in the course of the aorta, because the definition of aneurysms is that they are due to a lesion in one or in two of the three coats which constitute the walls of an artery, leaving the remaining coat or coats to be distended by the pressure of the circulating blood.

Aneurysms, therefore, produce symptoms according to their size and location, and we would begin with the aneurysms of the aorta. The first of these we would refer to are those which develop just above the aortic ring and the sinuses of Valsalva. They are usually small and are generally due to syphilis, but from their location they cause instant death by bursting into the pericardium. Here also or just above them may begin those aneurysmal changes which characterize the different forms of aneurysms as follows:

(1) The dissecting aneurysm, which results from injury or laceration of the internal coat. The blood dissects between the layers, hence the name "dissecting aneurysms." This occurs usually in the aorta and may last for years, forming, when complete, a double tube—the so-called double aorta.

(2) Another form, due to weakening of the coats of the aorta, causes the ascending portion of the arch to be uniformly dilated.

(3) The third and commonest form is the saccular, which, as its name implies, forms a bag more or less large, whose open mouth connects with the circulating blood. These sacs may be so large as to occupy a considerable portion of the thoracic cavity. In the course of their enlargement they may come in contact with bone, such as the sternum or the ribs, and then perforate them. How such a soft bag as an aneurysmal sac can make its way through solid bone is only explained by the pressure which it occasions being continuous rather than intermittent, because constant pressure, no matter how soft the agent producing it is, invariably leads to the removal by absorption of anything against which it presses, and which explains how the soft aneurysmal

sacs have no difficulty in making their way through some of the most solid bones of the body. This is only another illustration of the effectiveness of constant perseverance.

Other forms of aneurysms are the results of accidents in the progress of aneurysmal sacs: (1) One kind is called arteriovenous aneurysm, caused by a communication established between an artery and a vein. When this communication is direct, the chief change is in the vein, which is dilated, tortuous, and pulsating, so that it is termed an aneurysmal varix. These aneurysms are often the result of a stab or similar trauma, in which the injury to the artery and vein occurs simultaneously.

(2) Another form is the false aneurysm which is due to a rupture of all three coats, and the blood is free or circumscribed in the tissues.

(3) An occasional form of aneurysm is caused when an embolus has lodged in an artery and permanently plugged it; then aneurysmal dilatation occurs above the embolus.

(4) Lastly, a form occurs as a result of malignant endocarditis, when the blood becomes charged with micro-organisms; these, lodging at parts already weakened by various causes, set up ulcerative processes which may result in multiple aneurysms, some of which may be large and saccular. These are technically called microtic aneurysms.

Symptoms.—Aneurysms in the thorax may give rise to symptoms either by their direct pressure or by putting parts on the stretch.

Thus, in aneurysms of the ascending arch of the aorta the sac may compress the superior vena cava, causing engorgement of the vessels of the head and right arm, particularly if it presses on the right subclavian vein.

In aneurysm of the transverse arch, even though small, when they grow backward they may press upon the trachea and occasion a paroxysmal cough, or if pressing on the esophagus cause dysphagia. Thus, a small aneurysm from the lower wall of the arch may compress a bronchus, producing prolonged bronchitis, then bronchiectasis, and finally, suppuration in the lung, with death.

Aneurysm of the descending arch may also grow backward and erode the vertebra, causing great pain, sometimes compressing the spinal cord itself; or press the esophagus, with resulting difficulty in swallowing, or press upon a main bronchus, with effects already described. Aneurysms of the descending aorta may also cause all these symptoms, though, as they lie close to the diaphragm, they may not be detected until pressure signs of the lungs, with pain in the back and dysphagia, lead to inspection and palpation of the back.

Symptoms caused by the stretching produced by aneurysms occur most frequently when the recurrent laryngeal nerves are involved. Thus, the inferior or recurrent laryngeal, so called from its reflected course, is the motor nerve of the larynx. It rises on the right side in front of the subclavian artery, and winds from before backward around that vessel; on the left side it rises in front of the arch of the aorta, and winds from before backward round the aorta, at the point where the obliterated remains of the ductus arteriosus are connected with it. This illustrates why these tortuous nerves supplying the larynx so frequently become stretched by the growth of thoracic aneurysms, with the result of greatly affecting the voice or abolishing it, and frequently causing a cough strongly resembling croup. Inspection of the larynx by the laryngoscope may show complete paralysis of the vocal chords or of only one chord, sometimes constituting the first sign of a thoracic aneurysm. It sometimes happens that even large aneurysms occur in the thorax without giving rise to scarcely any symptoms, and may be found only at necropsy. This is due to the fact that the organs in the chest may sometimes be freely movable or else only partially attached. As the growth of an aneurysm is usually gradual, time is given to the parts to become accustomed to their displacement, which thus may occur without an appreciable symptom. Hence we read of aneurysms with symptoms and aneurysms without symptoms, facts which indicate with what care the chest should be examined in such cases.

We begin, therefore, with *inspection*. For this purpose a good light is essential. Not uncommonly our suspicions may be aroused by a localized flush on the cheek of one side; the conjunctivæ may be injected; but especial notice should be taken of the veins, both on the chest and on the arm. It is very suspicious to find one pupil enlarged. We may now carefully look for any sign of pulsation in the upper region of the chest. Thus, we may have pulsation that is due simply to dislocation of the heart, or to retraction of the lung. Aneurysmal pulsation is usually above the level of the third rib, and most commonly to the right of the sternum, either in the first or second interspace. Instead of localized pulsation, there may be only a uniform heaving impulse, which may be noticeable only when the chest is looked at obliquely in a favorable light. Posteriorly, when pulsation occurs, it is most commonly found to the left of the spine. This is a most valuable sign and can be detected if the patient is stripped and bends forward. On the anterior surface of the chest we may have in the upper part a pulsating tumor, which should not be confounded with a pulsating empyema, for these are always down and on the side.

Following inspection is *palpation*. When the aneurysm is deep seated and not apparent externally, the bimanual method should be used, one hand upon the spine and the other on the sternum. "There may be only a diffuse impulse. When the sac has perforated the chest wall the impulse is, as a rule, forcible, slow, heaving, and expansile, and has the same quality as a forcible apex-beat. The sense of resistance may be very great if there are thick laminæ beneath the skin; more rarely the sac is soft and fluctuating" (Osler). As Dickinson has pointed out, when there is a general heaving instead of any localized pulsation, this heaving is more noticeable when the physician's head is applied to the part, for the consequent movement of his head may be even evident to a bystander. A valuable sign is that when the hand is applied in the neighborhood of the sac a distinct diastolic shock may be felt. Occasionally, particularly in dilatation of the arch, a systolic thrill may be felt. At this stage of the examination the nature of the pulse should be noticed, both radials being examined at the same time, because a pulse in one radial may be quite different from the pulse in its fellow. This fact may be of decisive significance.

"*Percussion*.—The small and deep-seated aneurysms are in this respect negative. In the larger tumors, as soon as the sac reaches the chest wall, there is produced an area of abnormal dulness, the position of which depends upon the part of the aorta affected. Aneurysms of the ascending arch grow forward and to the right, producing dulness on one side of the manubrium; those from the transverse arch produce dulness in the middle line, extending toward the left of the sternum, while aneurysms of the descending portion most commonly produce dulness in the left interscapular and scapular regions. The percussion note is flat and gives a feeling of increased resistance.

"*Auscultation*.—Adventitious sounds are not always to be heard. Even in a large sac there may be no murmur. Much depends upon the thickness of the laminæ of fibrin. An important sign, particularly if heard over a dull region, is a ringing, accentuated second sound, a phenomenon rarely missed in large aneurysms of the aortic arch" (Osler).

In former times much stress was laid upon aneurysmal bruit, but these are by no means constant and not especially diagnostic when taken by themselves.

A valuable sign, which ought to be called Oliver's sign, is that of tracheal tugging, present in deep-seated aneurysms, who thus describes how to elicit it: "Place the patient in the erect position, and direct

him to close his mouth and elevate his chin to almost the full extent; then grasp the cricoid cartilage between the finger and thumb, and thus make steady and gentle upward pressure upon it, when, if dilatation in aneurysm exists, the pulsation of the aorta will be distinctly felt transmitted through the trachea to the hand." On the other hand, marked diminution in the breath-sounds on the one side are good indications of pressure on the lung substance by an aneurysm.

Of the symptoms, we may say that the commonest and most significant is pain, but cases occur in which pain is never complained of; when, however, the aneurysm erodes vertebræ the pain may be dreadful; its characters then are that it is localized, and if in the back the patients usually indicate its location by the thumb. Besides being constant there may be paroxysms of a lancinating character. Sometimes they are severe, when aneurysm is pressing and eroding the ribs, and then we listen over the sac protruding between the bones. When the aneurysms involve the aortic ring, as we have described, true anginal attacks occur resembling angina pectoris, radiating down the left arm and up the side of the neck.

Dyspnea, quite apart from that caused by laryngeal spasm, may occur from pressure from the trachea or the main bronchus, the symptoms of which we have already described. In such cases the breathing is often loud with a stridor.

Hemorrhage, however, is always of serious import, although it may occur as a sort of mere leakage from the mucous membrane of the trachea where it is pressed by the aneurysm. Yet more commonly it is the fatal result of ulceration of the sac into the lung or into the air-passages.

We need not discuss other aneurysms, which may occur in different parts of the body, such as popliteal aneurysms, because they are usually more of surgical than of medical interest. A word, however, is not out of place about a symptom frequently occurring in the course of the abdominal aorta, namely, throbbing. Compared with thoracic aneurysms, abdominal aneurysms are uncommon, but pronounced throbbing of the abdominal aorta, which may be easily mistaken for that of aneurysm, is not unusual in cases of neurasthenia and hysteria or sometimes in conditions of simple anemia. These may be very deceptive, because, on pressing the stethoscope deeply down, an actual bruit may be heard; it is otherwise if the patient complains of a fixed localized pain in the back. I had a patient who continued to complain of such a pain, always referred to the same spot, and, though he looked quite healthy, yet admitted that he had contracted syphilis twenty-two

years before; in time the case became clear by the erosion of the vertebræ, with symptoms of paraplegia. Throbbing of the mesenteric artery is also common in inflammatory colitis of dysentery, but rarely gives rise to any suspicion of aneurysm.

ENDOCARDITIS

As auscultation furnishes the chief means for estimating the conditions of the heart, so the student should recognize the many differences between pulmonary and cardiac auscultation. Thus, as to area, the heart being a single organ, occupies but a fraction of the space taken by the double apparatus of breathing. Much more than this, however, is the frequency of the sounds. I had a patient whose acts of breathing were thirty in the minute, or double that number of inspirations and expirations, but meantime he had with a pulse of 140 double murmurs at the aortic and at the mitral valves, besides the to-and-fro murmurs produced by pericarditis. He had, therefore, at least 720 sounds generated by his heart every minute. This fact alone shows how much more difficult physical examination of the heart is than that of any other organ, and the student should follow these simple rules: First, begin with the easiest thing to determine, namely, where the sound is heard plainest or loudest. This initial step should be very carefully settled. Second, in what direction the murmur transmits, or equally so, where it does not transmit; and, lastly, the most difficult of all, with what action of the heart it coincides.

As the conclusions from auscultation are thus so often uncertain, every other measure that may further aid in diagnosis should be resorted to, and among them are alterations in the normal sounds of the heart. Thus, accentuation of the second sound is of much significance in arteriosclerosis, and likewise in the pulmonary valves in the case of mitral stenosis. Palpation, also, is of great service for estimating the strength of the heart-beat. If this be strong and heaving on the left side, it indicates that the walls of the ventricle are sound. If the heart's impulse, besides being strong, occupies an extended area of the chest wall, it indicates hypertrophy. If, on the other hand, the impulse be feeble or absent, it shows weakness of the myocardium. If, again, the impulse be weak, but also diffused, it indicates the presence of dilatation. An important sign brought out by palpation is the presence of a thrill, which if felt in its proper place is almost pathognomonic of mitral stenosis. Percussion is of value in estimating the degree of the presence or absence of effusion into the pericardium, or of dilatation of the heart cavities. Meantime inspection is of great service

in locating the apex-beat of the heart, or, in other cases, especially in children, of bulging, due either to hypertrophy or to effusion.

Diseases of the heart are either primary or secondary: primary, when they originate in the heart itself or in its appendages; secondary, when the heart is deranged by conditions of the general circulation, notably by obstruction in the arteries, as that which occurs in arteriosclerosis. Of the primary affections of the heart, we begin with acute simple endocarditis. This is invariably due to an infection of some kind, the seriousness of which is according to the particular infecting organism. The commonest of these is by the *Diplococcus rheumaticus* of Wassermann and Poynton. This form of endocarditis is estimated by different writers to be between 20 and 30 per cent. These figures, however, are inaccurate unless special pains be taken to note the statistics at different ages. Thus, endocarditis from rheumatism occurs much more frequently in children than in adults, rheumatic endocarditis being estimated in children at 61 per cent. by West, and 80 per cent. by Grassicourt. This form of endocarditis is spoken of as the benign form, but it is only so in comparison with the malignant endocarditis, for no form of cardiac inflammation is really ever benign; the patients may recover in a few weeks, so that they mistakenly leave their beds. But the damage done to the cardiac valves and structures by rheumatic inflammation is often progressive and permanent, the changes in the valves resulting in such puckering of those structures that in time they either become incompetent, so as to produce regurgitation, or narrowed by stenotic changes, and then become equally serious obstructions. In most cases of stenosis of the mitral valve there is also incompetence with regurgitation, as will be noted further on. Endocarditis commonly begins as a simple valvulitis, and it is important to note why a rheumatic valvulitis is so much more serious than a rheumatic inflammation anywhere else.

Thus, an acute rheumatic arthritis is accompanied by much pain and swelling, with effusion into the joint, but this may, within twenty-four hours, be shifted to another joint, whereupon the effects of the inflammation in the original joint may quite disappear. But rheumatic valvulitis, on the contrary, is no transient matter, owing to the incessant movement of the valves. Were an inflamed joint, instead of being kept quite rigidly quiet, as is usually the case, moved back and forth more than 100 times a minute, the inflammation would produce serious structural changes, notwithstanding its rheumatic character.

The cardiac valves are covered by a delicate endothelium which serves the same protective office as the epithelial lining of mucous

membrane. Therefore, when this valvular endothelium is damaged and the subjacent tissue thus exposed, there follows as a result the precipitation of fibrin and of blood-platelets upon it. Later this deposit becomes invaded by various micro-organisms, such as streptococci, staphylococci, pneumococci, or gonococci, according to the nature of the case.

Every attack of rheumatic valvulitis, therefore, leaves its trace upon the affected structure, and as these rheumatic inflammations are very prone to recur, the valves become progressively altered in shape and in texture, with a further tendency of involvement of subsidiary tissues, such as the chordæ tendinæ and the papillary muscles. The chordæ tendinæ may become shortened and encrusted with deposits, notably of lime salts. These changes in time may not only render the valves incompetent to close perfectly, but also to adhere together, and thus constitute both an obstruction to the flow of blood from stenosis and, equally, regurgitation, through valvular incompetence. Lastly, the entire ring of the orifice may be transformed into a tissue of cartilaginous hardness, with such extensive deposits of lime salts as to justify the old term of "ossification of the heart."

The first attack of rheumatic fever is also more often followed by endocarditis than subsequent attacks, while in children the signs of arthritis may be very slight. To this also should be added that children are especially liable to chorea, which is a rheumatic affection, and as often accompanied by endocarditis as rheumatic fever itself. The endocarditis dependent upon rheumatic fever most frequently attacks the mitral valve; much less frequently, the aortic valve. In a ratio among 535 cases reported in St. Thomas' Hospital, the mitral was attacked in 87 per cent. and the aortic in 12 per cent. On the mitral valve the auricular surface is affected, while in the aortic valve it is the ventricular surface. In general, the valves of the left side are affected twenty times as often as those of the right.

Endocarditis may occur as early as the end of the first week of rheumatic fever, though in most cases not until the end of the second week, but it should be remembered from what we have already stated that tonsillitis may be the only antecedent of endocarditis, as it sometimes is of pericarditis.

Rheumatic fever, as we have remarked, is a disease of early life, and is progressively less frequent as a first attack after twenty-five years of age. Later in life endocarditis may follow intestinal ulceration, or the infection may proceed from the genito-urinary tract, such as from pyelitis, cystitis, or pelvic infections in women, and prostatic

infections in men. Scarlet fever may also produce endocarditis just as it causes arthritis. In other infections, such as measles or diphtheria and influenza, endocarditis is uncommon, although in the latter, namely, influenza and diphtheria, myocarditis is frequent.

It is doubtful if endocarditis, especially if severe, ever occurs without causing at the same time myocarditis, with resulting weakness and consequent dilatation of the heart walls. This should be borne in mind in the endocarditis of children, when temporary dilatation of the heart in rheumatic fever may occasion very serious symptoms, such as dyspnea and cyanosis.

The fibrin which is deposited upon the valves usually ends in the formation of warty growths which may be of different sizes and shapes. Sometimes they are pedunculated, with but slender attachments, so that they are broken off and carried elsewhere in the blood-current as emboli. In other cases they are firmly attached, and may grow into extensive granulations. Usually they are not attached at the free end of the valve, but somewhat within it. Their presence is not such a frequent cause of valvular murmurs as are other changes in the shape of the valves, which we have described.

Treatment of Simple Endocarditis.—As endocarditis should never be called benign, though it be of a simple rheumatic variety, so the question of prophylaxis is as important as any other in the management of these cases. Considering how often rheumatic fever is initiated by an infection of the tonsils, repeated washing of the throat after the fashion already described in the treatment of scarlatina and of diphtheria should be perseveringly followed from the first onset of rheumatic symptoms. I have thus often cut short a rheumatic infection in patients who were supposed to show a constitutional tendency to rheumatism. Another important measure is to insure perfect bodily and mental rest by directing the patient to remain in bed for weeks at a time. This necessary precaution is often difficult to find observed by the patient, but many a case of hopeless valvular change may be ascribed to the impatience of the patients from the irksome observance of the directions of the physician, especially by children. The old prescription of six weeks in bed for an attack of rheumatic fever has everything to recommend it, though in many cases six weeks is not long enough. Another cause of unmanageable endocarditis is the modern reliance upon the salicylates in the treatment of rheumatic fever. The salicylates have no power either to prevent or to modify the endocarditis. All that they do is to reduce the arthritic pain and the accompanying fever, while the endocarditis proceeds unchecked.

Quite different in my experience is the effect of the resort to alkalis, originally advocated by Dr. Fuller, of London Hospital, who maintained that no case of endocarditis need occur in rheumatic fever if his directions were followed. Instead of his complicated prescription, the same results may be secured by administering from 1 to 2 drams of the bicarbonate of potash, with a scruple of the citrate of potash, every two or three hours, until the urine becomes alkaline, when the doses might be given at longer intervals, to be resumed, however, so soon as the urine becomes acid. Meantime, the tincture of aconite is invaluable in such cases for soothing the excited heart. It should be given in doses regulated according to age, in order to secure slowing of the pulse and relief of the accompanying pain. Remarks on the treatment of rheumatic fever are also applicable here, because, owing to the accompanying perspiration, not only should the chest be carefully protected, but, if a child, the body should be enclosed in a cotton flannel bag, as heretofore mentioned.

MALIGNANT ENDOCARDITIS

While endocarditis is always due to an infection, we may not be sure what the special infection is. Cases which begin with all the characteristics of a rheumatic endocarditis may have a separate infection engrafted upon the original disease, with very uncertain signs of the change. Thus, I had a hospital patient whom I was told was suffering from severe malaria, as she had pronounced rigors occurring regularly at four o'clock in the afternoon, followed by high fever, ending in profuse sweating. Examination of her heart showed no symptoms of valvulitis, the sounds being normal in quality and in rhythm. From the aspect of the patient and the gravity of the constitutional symptoms, I said that the case could not possibly be mere *ague*. The patient died the next day during one of the paroxysms, and at post-mortem a clean-cut, infecting ulcer was found on the septum, which in no way involved either the mitral or aortic valve. In short, she died of what is very properly termed malignant endocarditis. This case illustrates the frequent difficulty of diagnosis in this grave complaint. The nature of her ailment would have been revealed by an examination of her blood, which was unfortunately omitted, for ulcerative endocarditis is accompanied by a high degree of leukocytosis, while malarial affections are characterized by a low count of leukocytes in the blood. If we rely upon the cardiac symptoms only, instead of the *Diplococcus rheumaticus*, the infecting organisms may be the pneumococcus, the gonococcus, or any one of the pyogenic organ-

isms, the *Staphylococcus pyogenes aureus* being, on the whole, the most common.

Malignant endocarditis may occur at any time in the course of rheumatic fever, with only an exacerbation of the original symptoms being present. In the majority of cases, however, there recurs an irregular pyrexia, which of itself is a suspicious symptom. When to this is added unmistakable signs of emboli, causing small ecchymotic spots on the surface, notably in the palms of the hands, or pain in the side and local peritonitis from infarction of the spleen, bloody urine from implication of the kidneys, or impaired vision from retinal hemorrhage, the diagnosis is no longer doubtful, but these derangements may also be accompanied by delirium, coma, or paralysis from involvement of the brain or its membranes.

In many cases, if not in most, the process starts from an old focus of valvular disease, and may then be extremely irregular in its course. I had a patient who had long suffered from chronic disease of his pulmonary valves, probably congenital; he continued to have irregular attacks of fever for two years before the terminal symptoms set in. Another patient, past middle life, who had old valvular disease, died at last with symptoms suggesting a distribution of emboli, coming, as it were, like a spray from his aortic valves, for he became so covered with ecchymoses of his whole skin that little remained of its natural color. Some of these cases present all the symptoms of a severe septicemia, and the infecting organisms may be isolated from the blood.

Another and more common class is characterized by typhoid symptoms, or a low fever, early prostration, delirium and coma, with profuse sweating. In these patients the cardiac symptoms may be so masked by the systemic conditions that only on the appearance of ecchymotic spots does the true diagnosis become established. These cases might easily be mistaken for the cerebrospinal fever, which goes by the name of spotted fever.

The most difficult forms to recognize are those uncommon cases termed "chronic infective endocarditis," in which, at first, fever is the only symptom. These patients may keep at work for months with nothing but a daily rise of fever, along with progressive weakness and anemia. Embolic features in them are not common, and they die from simple exhaustion, to reveal postmortem very extensive vegetative endocarditis, with large, irregular, but firm vegetations, which do not break away and thus form emboli.

Treatment.—We have no treatment for malignant endocarditis.

If patients supposed to have the disease recover, the inference is that the diagnosis was mistaken, and that they had simple endocarditis instead. Some have hoped that autogenetic vaccine cultivated from organisms present in the blood might be curative, but so far no trustworthy accounts of success by such vaccines have been reported. When the endocarditis has been produced by the gonococcus, the outlook is absolutely hopeless, however easy it be to cultivate a gonococcus vaccine from the blood.

It is noteworthy how often the history of malignant endocarditis is dated, by the patients themselves, from bathing in cold water. The first case of this affection in my own practice was that of a young boy, who could trace the beginning of his trouble to a single cold bath. I also had a young lady who remained in a cold sea-bath so long that she could not get up any reaction after it, and the first sign of her fatal illness was the appearance of the characteristic ecchymotic spots in the palms of her hands.

PERICARDITIS

The recognition of this common complaint may be easy, particularly in its first stages, or, on the other hand, so difficult that its presence during life will often be revealed only at autopsy. There is no serious disease, indeed, whose occurrence is so often unsuspected as pericarditis. By far its most common cause in early life is rheumatic fever, and on that account it should be looked for in chorea, or it is often associated with that common precursor of rheumatism, tonsillitis. Pericarditis may occur so early in such cases as to precede any symptoms of arthritis. On the other hand, the pericardium is attacked in tuberculosis, and likewise in later life it may complicate nephritis or even gout. It is common also in other septicemic infections, such as puerperal fever, ulcerative endocarditis, and general septicemic conditions produced by pyogenic cocci. In fact, it may occur as a terminal infection in any chronic constitutional disease.

The occurrence of pericarditis in rheumatic fever is variously rated by different writers, some putting it as low as 6 per cent., and others at 30 per cent., the higher figures being the more probable. Though all inflammations of serous membranes lead to serious sequelæ from adhesions between the two surfaces of the membrane, yet in rheumatic inflammations of the pericardium these may not at first excite suspicion, and are only found out by the presence, over the right ventricle, of its to-and-fro sound. Meantime the endocardial or valvular sounds are quite distinct. When, however, a large effusion has taken place

into the pericardial sac, the endocardial sounds may become very much muffled, so as not to be readily detected. This weakening of the endocardial sound is a valuable sign of pericardial effusion. The friction sounds of pericarditis are readily detected because they seem to be superficial and near the ear, and on that account are better appreciated by the ear itself than by the stethoscope. When, however, the area of the inflammation is limited, it would be better to rely on the stethoscope. Often on palpation the finger may detect a fremitus there. Both the fremitus and the friction sound will soon disappear when effusion in the pericardial sac occurs, though they may remain for some time at the base of the heart and at its apex. In such cases the effusion may be simply dry; otherwise it is serofibrinous, and when it becomes thick the two surfaces when separated may present many long threads, so as to give the name, among old writers, of a hairy heart. When still thicker, the effusion becomes honey-combed, much as if the surfaces were separated by butter. Should the exudation, however, be more fluid, the friction sound may disappear while the endocardial sounds become more or less muffled. If the effusion is very liquid, it may accumulate to a large extent, whereupon the precordial percussion area of dulness greatly increases, becoming somewhat pear shaped, with the base below, and ending above in the shape of a truncated cone.

There is no affection whose signs by auscultation are so variable as in pericarditis, present one day and absent another, and often altered by simple changes of position, such as leaning forward. These serofibrinous exudations are often absorbed with great rapidity, leaving in time the two surfaces of the pericardium—the visceral and parietal—permanently adherent, and yet in many cases with but few signs of the change. In some cases, however, from the very beginning the patients complain of more or less precordial pains, which may have to be relieved by opium. Pericarditis is pretty sure to be accompanied, if at all severe, by myocarditis, and, as remarked in our chapter upon Rheumatic Fever, this softening of the heart walls easily leads to cardiac dilatation. It is often surprising in the rheumatic cardiac inflammations of children how soon serious symptoms accompanied by severe dyspnea may develop. In this form of the disease the exudation, from being very slight, increases in amount, but nevertheless does not present the serious aspect which occurs if the exudation becomes bloody or purulent. In some cases the effusion of fluid may become so great as to endanger life from embarrassment of the heart. Although the fever at no time is apt to be high, often in the worst

cases not exceeding 102° or 103° F., yet the dyspnea is distressing, and the patients are very restless, the face becomes dusky, the pulse is very small, and we may have the pulsus paradoxus, in which the pulse is affected by the movements of respiration. Delirium may then set in, often of a peculiar kind, marked by obstinate taciturnity; at other times, noisy muttering. Should the exudation be very large in amount, sometimes from 1 to 2 liters in quantity, the ominous symptom of dysphagia makes its appearance. The left lung also becomes compressed at its base, and an area of dulness on percussion develops posteriorly between the spine of the scapula and the vertebræ (Ewart's sign). Similarly, there is an absence of resonance in the fifth right intercostal space, called Rotch's sign. In children there may be an actual bulging produced by the effusion in the precordial area. The most important clinical sign then is dyspnea.

Pericarditis is a very frequent accompaniment of pneumonia, produced by extension of the pleuropneumonic process to the pericardium. It is largely on this account that the existence of pericarditis is masked by the sounds proper to both pneumonia and pleurisy, such as bronchial breathing and pleuritic friction. Large effusions into the pericardial sac have, on this account, been overlooked until they are revealed at autopsies.

Treatment.—The treatment of pericarditis in the acute stage is usually that of the diseases of which it is a complication. It is otherwise when some of its mechanical effects are produced, such as the embarrassment of the heart by the amount of effusion. It would be well to begin by rubbing the precordium with blue ointment of mercury. If there be much pain, however, this may be preceded by leeching, which sometimes may give great relief. After the acute inflammation has subsided, large blisters often produce surprising results in causing both subsidence of pain and dyspnea and absorption of the effusion. If, however, the mechanical effects of the effusion are very serious, as above described, aspiration affords the best relief, both in serous effusions and when there is blood present from tuberculous inflammation. In them the aspiration may be repeated as often as occasion requires by the symptoms. The needle should be introduced upward and backward, close to the costal margin in the left costal xiphoid angle. Should the effusion, however, be purulent, nothing short of incision of the pericardium and drainage will answer in these serious cases.

PERI-PERICARDITIS

It is otherwise with the chronic result of extensive pericardial adhesion to the pleura or to the chest wall. In these cases the movements of the heart become very much embarrassed, as they prevent its systolic contraction, thus leading to extensive dilatation, dropsy, and engorgement of the liver. On inspection, the extent of the cardiac impulse is greatly increased, with similar excursions of the visible impulse beat, which may extend from the third to the sixth interspace. One of the best signs of this condition is that of an actual systolic retraction due to the pull of the adherent heart upon the lower movable rib spaces. . . The heart may be so dilated in these conditions that its valves become incompetent, often leading to ascites. I have sometimes produced a mitigation of these symptoms by firmly strapping the lower ribs on the left side, applying the straps from the vertebræ to the middle line anteriorly. The greatest relief, however, is secured by Brauer's operation of cardiolysis, 5 or 6 cm. of the fourth, fifth, and sixth left ribs being resected, so as to set the heart free from its fibrous entanglements. This operation has been successful in cases that otherwise would soon have succumbed.

BRADYCARDIA

Bradycardia, or slow pulse, is sometimes of very little significance, for I have known it to occur in perfectly healthy persons who throughout life may have a pulse-rate of 40. Pathologically, it is very common in jaundice and in old persons with thickened arteries and myocardial changes. It should be noted that it sometimes occurs in meningitis.

In all cases a careful comparison should be made between the pulse at the wrist and the frequency of the heart-beat, for the pulse at the wrist may count only 40, while the heart-beat is 80, from the inability of the heart to propel the wave so far as the wrist.

Bradycardia comes on in aged persons with widely distributed changes in the arteries and who also have weak hearts. Such patients frequently have epileptiform attacks, which cause them to fall in the street, and with temporary fits of unconsciousness. I have had cases, however, of a habitual pulse as low as 30 to 36, with frequent attacks of unconsciousness, and yet without any detectable abnormality either in their arteries or in their heart walls. In the cases just referred to, occurring in elderly persons, relief may be very prompt on using heart stimulants, of which the most efficacious in my hands

has been a pill of powdered squills, $\frac{1}{2}$ dram; caffein citrate, $\frac{1}{2}$ dram; and strychnin sulphate, 1 gr., made into 30 pills; one before each meal.

These patients also do well under 5-gr. doses of sodium iodid three times a day, and should always take one of Blancard's pills of iodid of iron after breakfast and dinner. It is well for such patients to carry with them a bottle of aromatic spirits of ammonia and take a teaspoonful of it in water, to which should be added from another bottle 15 drops of tincture of nux vomica whenever they feel any symptoms of cerebral anemia, such as dizziness or ringing in the ears.

Bradycardia is not uncommon during convalescence from pneumonia, when the above-mentioned pill may be administered with advantage.

CHRONIC VALVULAR DISEASE

In any case of chronic valvular disease the practical question is, How long can the heart, by its own powers, compensate for the difficulties in the circulation? The mechanism of compensation is so varied and so constantly differs in each case that it neither can be defined nor classified. Thus, the heart is no mere pump, but a vital organ, whose actions are determined, both in health and in disease, by muscular and by nervous forces, the degree of either of which varies in each case. To estimate, therefore, how long these compensations will last or how soon they will fail is impracticable, and our only resource is to note the necessary factors in the case.

The first factor is hypertrophy of the musculature of one or more of the heart cavities. This is according to the law that muscles hypertrophy in proportion to the work which they have to perform, but though hypertrophied muscles seem to be in all respects like normal muscles, it is well to note that hypertrophied muscles more easily degenerate than normal muscles. We must expect, therefore, that hypertrophy of the heart walls cannot last indefinitely as such, but that sooner or later they will degenerate, usually with dilatation of the affected cavities. For how long this terminal dilatation or degeneration may be postponed is the practical aim of the instructed physician.

To do this, we should bear in mind what strengthens muscular tissues in health. First, muscular power depends directly upon oxygenation. In all animals muscular power is proportioned to the activity of breathing. Huxley calculates that if we could take in as much oxygen from every part of our bodies as the flea does, instead

of by the restricted apparatus of our lungs, a man could, unaided, move the whole massive structure of Newgate prison. But in our own species we constantly meet with illustrations of this law. Sedentary habits in us invariably induce weakness in all muscular tissues, because we scarcely breathe one-half as actively when seated as we do when walking. On that account women suffer from organic muscular weakness far more than laboring men, along with debility of all muscular functions, so that many of them are constipated throughout life, and are prone to relaxation of the pelvic organs, with a consequent disturbance of their circulation. Thus arise many derangements of uterine functions, including that of parturition itself, which are unknown to women who work like men out in the fields. I have repeatedly known elderly men who were troubled with weakness of the bladder to have these disabilities disappear during a prolonged vacation out-of-doors. It is due to this law that Oertel's treatment of cardiac debility by carefully regulated hill-climbing was so successful. On the same principles, the administration of iron is of great value in conditions of cardiac debility. The one use of iron as a remedy is that it increases hemoglobin, and by so doing increases the amount of oxygen in the blood. It is by the iron which the blood contains that we breathe, and the practical question is how to have the iron assimilated, as we mentioned in the treatment of chlorosis. Naturally, the iron which is contained in our food is almost infinitesimal in quantity, and we know very little of the methods by which iron becomes a natural ingredient of the red corpuscles. Whenever we give iron as a medicine the doses are far larger than it is possible for the system to assimilate, so that it is excreted unchanged by the bowels and thus blackens the feces. If anyone should have the mainspring of his watch broken, he could not remedy it by putting his watch in a bag of watch-springs, but this is scarcely better than the way in which we give doses of iron to be swallowed. A great many unknown nutritive, metabolic processes intervene between iron put in the alimentary canal and iron in the red corpuscle. Moreover, iron is wholly useless, if not mischievous, in the treatment of any form of febrile anemia. It is thus of no use in the treatment of the anemia of pulmonary phthisis, but should be administered in all non-febrile anemias, care being taken to combine it with whatever remedies promote the appetite and digestion. In all conditions of cardiac debility without fever iron should be our chief reliance among drugs. Thus, in the cardiac debility of elderly persons, shown by a tendency to swelling above the ankles, I am accustomed to administer iron in the following prescription:

BLACK TONIC (*Mist. ferri et ammon. carb.*)

R. Ammon. carb.....	℥iss;
Ferri ammon. cit.....	℥j;
Tinct. nucis vomicæ.....	℥ij;
Tinct. quassiae }	℥℥ ℥iv;
Tinct. gentian. }	
Syrup. aurantii.....	℥iij;
Aquæ camphoræ.....	℥v.

Sig.—Tablespoonful in water after meals.

For every case, therefore, of threatened heart failure the aim of the physician should be to have his patient breathe the open air by night, if possible, as well as by day, just as in the treatment of tuberculosis. These principles find a special illustration in the management of patients with aortic regurgitation.

AORTIC STENOSIS

In comparison with aortic insufficiency, aortic stenosis is a rare disease, usually associated with extensive calcareous changes in the arteries of elderly patients. The ventricles in this condition may be much hypertrophied without any corresponding dilatation. It is curious that inspection may fail to reveal any area of cardiac impulse, while percussion is always less than the wide area of dullness in aortic insufficiency, but palpation often gives us a thrill of marked intensity. On auscultation, a rough systolic murmur, heard loudest at the aortic cartilage and transmitted upward into the carotids, is the most constant symptom. A similar murmur of moderate intensity may not necessarily mean obstruction at the orifice, but may arise from roughening of the valves or from the anemic state of the blood, but in aortic stenosis the murmur has a much harsher quality, is louder, and may even be musical. The pulse in aortic stenosis is small, but regular. When the stenosis is extreme, symptoms of deficient blood-supply to the brain, such as faintness and dizziness, may occur. When degeneration and dilatation set in, insufficiency of the mitral valve develops, with its accompanying dyspnea, cough, and dropsy of the legs. In diagnosis a sphygmographic tracing is very characteristic of this lesion, showing a curve of slow rise, a broad well-sustained summit, with a slow decline in every respect, quite opposite to the tracings in aortic regurgitation, the pulse meantime showing none of the characteristics of the collapsing Corrigan pulse.

Treatment.—For aortic stenosis the best treatment is by aconite given in sufficient doses to slow the pulse; that is, in doses of from 5 to 10 drops of the tincture, of the Pharmacopeia of 1890.

AORTIC REGURGITATION

The commonest cause of aortic regurgitation is from rheumatic endocarditis altering the valves, so that they do not properly close together during the diastole of the ventricle. This disorder, when rheumatic in its origin, may occur in childhood, when, without arthritis, chorea may have affected the child because chorea causes endocarditis oftener at that time of life than arthritis. Probably on this account we read of aortic incompetence being due to congenital malformations of the valves, but such congenital affections must be rare. In endocarditis, as we have explained, not only do the valves become distorted, but the chordæ tendinæ may become, by shortening, the most efficient agents in the production of this lesion, but, however produced, aortic incompetence may be readily compensated for by increased hypertrophy of both left ventricle and auricle, so that many cases may live for years but little affected by what may at any time become a very serious heart affection. One thing is always certain, that owing to the regurgitation through the incompetent valve into the left ventricle already filled during diastole, the heart has to perform much heavier work, as it throws out a larger quantity of blood than normal with each systole.

As the valves become more and more incompetent, the most recognizable changes may be due to pulsation of the peripheral arteries. Thus, on baring the arm and flexing the elbow, the artery may be seen to jump, as it were, in its bed from the middle of the forearm to the middle of the arm. At the same time both carotids visibly pulsate, and if the arm be elevated the pulse-beat of the heart may be noticed in the changing color of the finger-nails during systole and diastole. The pulse at the radial presents the so-called "water hammer" or Corrigan's pulse, consisting of a full beat followed by immediate collapse, characteristics never found in a normal pulse. "The sphygmographic tracing is very characteristic, the high ascent, the sharp top, the quick drop, in which the dicrotic notch and wave are very slightly marked."

As we have remarked, the double work performed by the heart in this trouble leads to hypertrophy of its walls more marked than in any other cardiac affection, causing what is termed the "bovine heart," which may weigh 35 or 40 oz.

So long as the patient is not affected by arteriosclerosis, good compensation may last for years, but so soon as general arterial thickness sets in, the terminal stages of this affection begin. Instead of the initial shortness of breath and tendency to palpitation, dilatation of the heart cavities commence, which is shown by great increase in the per-

cussion area of dulness, particularly downward and to the left. So long as dilatation has not occurred, the heart impulse is strong, and the extent of the wave of the beat against the chest wall becomes very apparent. When dilatation with weakening occurs, the clinical symptoms change, the breathing is very short, and signs of cerebral anemia develop, such as dizziness and ringing of the ears, with a marked tendency to syncope. There is no other affection of the heart which is so frequently the cause of sudden death, but mental derangements are also very pronounced, the patients are subject to terrifying dreams, and while awake may have very uncomfortable delusions. These patients, therefore, should be carefully watched, for they often attempt suicide. Owing to the disturbance of sleep, they frequently cannot lie down, but sleep sitting in a chair. It is in them that a full dose of opium at night produces the best effects.

Auscultation usually affords the most unmistakable signs. At the base of the heart a pronounced murmur occurs which is propagated down midsternum to the apex, but not beyond the apex to the left. Not uncommonly a thrill can be felt accompanying the murmur, and sometimes present even in the carotids. I have known this murmur to be musical. The only murmur with which it may be confounded is the presystolic murmur of mitral stenosis, but usually these two murmurs can be easily differentiated. In some cases the murmur is not most distinct at the base of the heart, but rather at midsternum. Its coincidence with the diastole, however, is always recognizable.

When compensation begins to fail, remedies should be carefully selected which steady the heart. Digitalis is contra-indicated, owing to its property of constricting the arteries. Its place may be taken by powdered squills, in a dose of 1 gr., along with caffein citrate, from 1 to 2 gr., and spartein sulphate, $\frac{1}{2}$ gr., taken in pill, three or four times in twenty-four hours. For disturbed sleep the following prescription may be tried (chloral and morphin):

R. Ac. hydrocyanici dil.....	3ij;
Chloral.....	3ij;
Magendie solution.....	gtt. xxxvj;
Syr. aurant.....	3iss;
Aq. menthe.....	ad. 5vj.—M.
Sig.—Dessertspoonful to tablespoonful, at night.	

If this fails, opium is our best remedy, from $\frac{1}{4}$ to $\frac{1}{2}$ or 1 gr., taken at night, with 4 or 5 gr. of powdered rhubarb to prevent constipation.

MITRAL STENOSIS

Separate mention may be made here of the production of mitral stenosis. It is difficult to account for its greater prevalence in females than in males; thus, at the Royal Infirmary of Edinburgh, during sixteen years (1893 to 1908) there were 324 males and 523 females admitted for pure mitral obstructions. In the majority of cases the two mitral cusps become united, so that the valve presents the form of a hollow cone pointing downward toward the apex of the heart, with an outlet that may have only the diameter of a goose-quill. This is more common in children than another form, which is called the button-hole or irregular slit aperture, most frequent in adults. The changes in the walls of the auricles in mitral stenosis are usually very pronounced. As remarked before, mitral stenosis may also be accompanied by mitral incompetence.

Mitral stenosis is always a serious affection, largely because it is progressive. The patients are short breathed, on account of the special tendency to engorgement of the lungs. On this account also they are subject to cough, with passive congestion of the bronchial tubes. In no heart affection also is there such a tendency to hemoptysis, which, if due to mitral stenosis, is best treated by wet cupping over the precordial region. It should also be borne in mind that the engorgement of the auricle may be so great as to cause sudden death. This is the cardiac lesion in which palpation alone may be diagnostic, for on placing the tip of the finger at midsternum over the mitral orifice a strong thrill may be felt, which is usually limited in its area. Percussion shows an increased area of dulness across the base of the heart. Auscultation gives very characteristic signs, a second sound being much more clearly accentuated at the pulmonary than at the aortic area. The pathognomonic murmur is heard over the site of the mitral valve, which is definitely presystolic in time. It is loud and harsh, increasing in its intensity until it abruptly ceases with the first sound. This murmur does not transmit in the characteristic directions of the murmur of mitral incompetence, but it may readily be confounded with the murmur of aortic regurgitation, which occurs during diastole and which is often accompanied by a thrill, but this thrill is not so pronounced as in mitral stenosis. It may be distinguished by the presystolic murmur of mitral stenosis, being much more harsh than the aortic murmur and by its abrupt termination with the first sound. The pulse is small and very frequently irregular.

Owing to engorgement of the lungs in mitral stenosis, it is a serious matter to have any bronchitis develop in these patients. This com-

plication is very apt to occur in them, and should be promptly treated by the remedies already mentioned for that complaint.

Treatment.—The dyspnea of mitral stenosis is not to be relieved by digitalis, a drug so often administered in heart disease in a routine and mistaken manner as if it were a heart tonic for all purposes. Digitalis, on the other hand, while contracting dilated heart cavities better than any other known remedy, yet simultaneously contracts all the arteries, and thus raises blood-pressure, a very undesirable matter in mitral stenosis. Instead of digitalis, powdered squills, in grain doses, may be prescribed as a heart stimulant, along with 1 to 2 gr. of caffein citrate, and $\frac{1}{2}$ gr. of spartein sulphate, along with from $\frac{1}{40}$ to $\frac{1}{80}$ gr. of strychnin. Iron also ought to be administered, as before stated, on general principles.

MITRAL REGURGITATION

For its final effects mitral regurgitation produces the most extensive lesions of any affection of the heart, in that it causes dilatation and hypertrophy of all four chambers of the heart in the following order: First, regurgitation occurs from the left ventricle into the left auricle with each systole, thus further distending the auricle already filled with blood as it comes in by the pulmonary veins; second, with each systole of the left auricle a larger amount of blood than normal is emptied into the left ventricle, leading to its dilatation and hypertrophy; third, the blood in the pulmonary veins is so jammed back into both arteries and veins of the lungs that the right auricle is obliged to do more work to discharge its blood into the lungs, and thus the right ventricle becomes dilated and hypertrophied; lastly, the right auricle is unable to discharge its blood into the right ventricle without more than usual work, on account of the stasis of blood in the cavity of the right ventricle. Also the auricle, therefore, becomes dilated and hypertrophied. This, in turn, causes tricuspid regurgitation, so that the whole systemic venous system becomes distended with blood, causing engorgement of the liver and of the alimentary canal generally.

To return to the chronic venous stasis in the lungs: this leads to congestion of the bronchial mucous membrane, if not to actual hemoptysis. Chronic bronchitis, therefore, with cough is one of the results of mitral incompetency. Meantime, this condition of the circulation in the lungs leads to what is called brown induration of the lung tissue.

In no form of heart disease, however, are the compensatory powers of the heart so well illustrated as in mitral regurgitation. Owing to

hypertrophy of both the right and left ventricles, the discharges of blood from those cavities may continue normal in amount for many years, so that the patients are unaware that they have any serious cardiac derangements, except that they are more prone than usual to short breath; often they are wholly unaware of having any heart trouble until it is accidentally discovered by a physician on auscultation. After a time, however, from any of the many causes of malnutrition of the heart, compensation begins to fail, one of the first signs being paleness with a slight tinge of jaundice and blueness of the lips; but patients may present these symptoms for a long time without being seriously discommoded. As failure in compensation increases, the general symptoms become more and more serious. The over-filled veins begin to leak into the tissues, causing dropsy of the feet, which increases upward until ascites accumulates in the abdomen and in the serous sacs of the pleura, along with general anasarca. The patients finally are unable to lie down, and are apt to have distressing attacks of sudden awakening on falling asleep. Digestion becomes much impaired from the general venous stasis in the whole alimentary tract; the kidneys also become congested, the urine diminishes in amount, is high colored, and loaded with urates, the breathing naturally becomes short and labored, with a supervention of pulmonary edema, and death usually occurs from asthenia.

Mitral incompetency occurs from two widely different conditions, the first ordinarily occurring in early life from endocarditis, producing valvulitis, with results which we have already described. But the most serious forms of mitral regurgitation may occur without any valvulitis at all, and that is when the heart is hypertrophied from extracardiac causes. Thus, it occurs in chronic Bright's disease from widespread arteriosclerosis. The heart, from its increased work in keeping up the circulation through the obstructed arteries, first hypertrophies and then dilates, so that the auriculoventricular orifice may no longer be perfectly closed during the ventricular systole. Often, however, other causes of muscular debility produce the same result, one of these is long-standing abuse of alcoholic stimulants. It should be remembered that this is one of the commonest causes of premature senility, both in the muscular and in the nervous system, characterized in the heart by degeneration of the myocardium and consequent dilatation of the heart cavities. In addition to this, every strain in lifting or in manual labor tends to the same result, so that we find in hospitals many such patients from the lower classes, and thus account for the greater frequency of this form of heart disease among men than among women.

It should, therefore, be borne in mind that mitral regurgitation may have nothing to do with valvular disease.

Treatment.—It is for the effects of mitral regurgitation that digitalis is our chief anchor. Digitalis works best in cardiac dilatation by itself diminishing the dilatation of the cavities, which it does by cramp-like contraction during the systole. Hence, digitalis should not be given when there is no dilatation. As it restores the heart more nearly to its normal conditions, it greatly increases the heart's power to re-establish the natural flow. One of its first effects is to increase the flow of urine, and so assist the removal of dropsy and of effusions into the serous cavities. The lungs also become rid of their pulmonary edema, and the embarrassed portal circulation becomes so far relieved that the gastro-intestinal digestion is likewise improved. Along with digitalis, however, other remedial measures should be simultaneously adopted, particularly those which prevent the action of the digitalis in contracting the arteries. Nitroglycerin and other nitrites, on account of their evanescent action, are not as permanently efficient vasodilators as aconite, as we have already mentioned in the treatment of arteriosclerosis. These all, however, may be of great service in preventing arterial contraction, and, therefore, should be administered with each dose of digitalis. Aconite should be given in 15-drop doses every three or four hours along with the digitalis. Other advantageous adjuncts during the administration of digitalis are purgatives, such as a full dose of Epsom salts, taken in the morning, or the compound cathartic pill, taken at night twice a week. Calomel, in fact, is one of our best diuretics. The compound jalap powder is also one of the best purgatives to be used alternately with the other remedies of this class, because no single purgative should be too exclusively employed.

When the kidneys are embarrassed it may be administered in the form of a compound diuretic pill consisting of 1 gr. of calomel, 1 gr. of powdered squills, and 1 gr. of digitalis. Should the dropsy, however, continue to increase, puncture of the legs below the knees may be resorted to, especially by means of Southey's capillary tubes. The skin of the legs, as it has been devitalized by the subcutaneous, watery effusion, should be very carefully disinfected before making the punctures, for sloughing or even gangrene may occur. It is remarkable that when successful the dropsy may thus be very strikingly relieved by removing so many of the mechanical causes of circulatory embarrassment.

In all cases of anasarca due to mitral regurgitation the administra-

tion of digitalis should be begun by full doses of a tablespoonful of the officinal infusion given four times in the twenty-four hours, after the bowels have been opened by a dose of 5 gr. of calomel with 35 gr. of jalap powder. A tablespoonful of the infusion of digitalis should be taken four times in the twenty-four hours for three days and then intermitted, after which the compound diuretic pills already mentioned should be administered for three more days; after this 30 drops of a mixture of equal parts of tincture of digitalis, tincture of strophanthus, and tincture of nux vomica may be continued for a number of days. Meantime doses of iron should be kept up in a mixture containing 10 to 15 drops of the tincture of chlorate of iron with 1 dram of the sweet spirits of niter, and 1 dram of the syrup of ginger in peppermint-water.

FUNCTIONAL DISORDERS OF THE HEART

PAROXYSMAL TACHYCARDIA

This strange affection I have often met in my experience. It has no connection with other forms of tachycardia, such as Graves' disease or tabes. I have found it to occur exclusively in persons after forty years of age. The attacks set in abruptly, without any connection with the taking of food or exercise, and in a few minutes the pulse rises to 200 or more. It is remarkable that the patients, as a rule, have no dyspnea, and are only discommoded by their extreme tachycardia; the attacks may subside suddenly after twenty-four hours; in some cases not for three or four days.

Treatment.—I have found no treatment efficacious for the attacks, though on general principles I would advise absolute physical quiet, for cases have been reported of patients dying from this complaint with symptoms of heart failure. I may say that no cardiac sedatives, such as aconite or veratrum viride, seem to have any effect on the attacks.

ANGINA PECTORIS

The symptoms of this deadly affection in typical cases are those of sudden onset of agonizing pain in the chest, with the sense of great constriction, as if the chest were in a vise, and radiation of the pain up the neck and down the left arm, often to the fingers, with a feeling of numbness and tingling. Accompanying this pain is a premonition of impending and immediate dissolution. Thus, a gentleman of my acquaintance exclaimed in his only attack, "I did not know that death would be so painful," and immediately expired. Other cases of angina

pectoris, however, are not so severe, as they may frequently recur for months, or even years, during which the characters of the attacks are the same as in the fatal cases, only more temporary and less severe. In these cases the exciting causes are varied, mental emotion being one of the commonest. This was recognized by John Hunter, who complained that anyone who vexed him might be the cause of his death, which was true, for he died in a fit of anger. Other causes are from sudden muscular effort, for these attacks but rarely occur when the patient is quiet. Another cause of these attacks, which it is doubtful to class as either a cause or an effect, is from the supervention of gastric flatulence, for many cases are quickly relieved by an eructation of gas. A still further exciting cause is from exposure to sudden cold, as might be expected from the effects of cold in contracting so many widely spread arteries of the surface. It is curious that this affection occurs so rarely among women. In my private practice I have known of only two women who succumbed to it, one having her first attack in the morning, and a return three hours afterward, when she quickly died. Another had repeated attacks for many months before she finally succumbed in the last one. The theories of the production of angina pectoris are numerous, but to my mind the most probable one is that of Heberden, to whom the profession owes the first treatise on this disease. He ascribed the attacks to cramp of the heart, either from overwork or other cause of spasm of the coronary arteries; thus cramp may be induced in the muscles of the calf of the leg by too prolonged dancing, but on account of the situation of those muscles this is a trivial affair; while a cramp of the heart, if at all prolonged, must necessarily be fatal. A further confirmation of this theory is the fact that any muscle may be thrown into tonic cramp by ligation of its artery or similar means of shutting off its arterial supply. Cramp of the heart, therefore, may be readily imagined as occurring in angina pectoris from spasm of one or more of its coronary arteries. It is curious that experimental ligation of a main coronary branch may at first seem to have but slight effect, but, in a shorter or longer period of time, the animal suddenly dies. About the physical causes of this affection there is but little disagreement, as sclerotic changes in the coronary arteries, if not fibrosis in the myocardium, are so often found. One of my patients who died suddenly during his first attacks, at autopsy showed no microscopic changes in the coronaries or in the heart walls, but it is doubtful if careful microscopic search might not have revealed degeneration both in the coats of the coronaries and in the myocardium.

Symptoms.—It is curious that the pulse is often so little affected during an attack, being usually neither irregular in rhythm nor changed in size. As a rule, however, the pulse is small and of high tension, the face is ashy pale, and the skin is bedewed with cold perspiration. Besides the radiations of pain which we have already mentioned, they may radiate to distant parts. Thus, Osler mentions a case in which they radiated to the jaw, and another to the left testicle. This affection, as we might expect from its connection with arteriosclerosis, is markedly hereditary; thus, in the well-known case of Dr. Thomas Arnold, it occurred in three successive generations of his family. The rule is that it occurs in persons who are considerably past middle life. When it develops in persons under twenty-five years of age the presumption is strong that it is due to syphilitic disease of the aorta and coronaries. I was once called to see a patient who was thirty-five years of age, who admitted that he had had syphilis. I went out to get some remedies, and on my return I found him dead, and I was told that because the pains had passed off he arose and tried to move a piano, and while doing so dropped dead. As might be expected, angina pectoris very frequently develops in the course of aortitis, and may be one of the first symptoms of the beginning of an aortic aneurysm. Severe anginose pains also are frequent accompaniments of aortic regurgitation.

Treatment.—For the attacks themselves we must rely upon immediate vasodilators, and for this purpose the patient should always have with him capsules of so-called perles of nitrite of amyl, which should be broken and inhaled. It is wonderful how quickly a relief of the paroxysm may be thus attained, and this is an indication of the cramp being caused by arterial spasm. Nitroglycerin also is of great service, and may be administered in a prescription of $\frac{1}{2}$ gr. dissolved in 6 oz. of water. A teaspoonful of this contains $\frac{1}{8}$ gr. of nitroglycerin. In chronic cases a patient should carry a small bottle of this solution, so as to swallow a teaspoonful of it with the first onset of pain in walking or in muscular exertion. I have had patients who became accustomed to this dose, and who had to take two to four times the quantity afterward to produce the same effect. The sign of having taken enough is from throbbing of the temples with headache. No danger, however, need be apprehended from this drug. A patient should also swallow a dram of Hoffmann's anodyne or compound spirits of sulphuric ether, taken in a little water, for this is promptly followed by eructation of gas from the stomach. A similar relief may be obtained by taking a teaspoonful of the spirits of chloroform. The real treat-

ment, however, should be prophylactic. Every patient subjected to true anginose symptoms should systematically take the remedy for conditions of arteriosclerosis which we have already spoken of, namely, 5 gr. of sodium iodid, three or four times a day, along with 4 to 6 drops of equal parts of Balfour's liquor strychni hydrochlorici and liquor arsenici hydrochlorici. The main reliance must be upon aconite, which should be given in doses of 10 drops of the tincture of the Pharmacopeia of 1890 four times a day, and continued for months together. I have had elderly patients who have thus continued the aconite for three and four years, and who were obliged, on omitting it, to return to its use because of a return of anginose symptoms.

FALSE OR NEUROTIC ANGINA PECTORIS

In contrast with true angina, attacks of this affection are very frequent in women. During the attacks the patients become restless and often very cold, especially in the feet, with severe pains about the heart, often causing faintness or cyanotic change in the face. It is also common for them to have a great deal of flatulence in the bowels, the pulse may be very small and irregular, and the general symptoms are not unlike an aggravated attack of hysteria.

Treatment of the attacks themselves should be by Hoffmann's anodyne, or teaspoonful doses of the spirits of chloroform. The prophylaxis of these affections is based mainly upon measures for the relief of chronic hysteria, of which a course of aloëtic purgatives, or else 10-gr. doses of benzoate of sodium, with 4 or 5 gr. of powdered rhubarb, several times a day, should be adopted.

CHAPTER III

DISEASES OF THE LYMPHATICS

HODGKIN'S DISEASE

IN 1832 an eminent anatomist at Guy's Hospital described Hodgkin's disease as a specific derangement of the blood, characterized by enlargement of the lymphatic glands in different parts of the body which are distinct from other glandular derangements often confounded with it. Thus, it is separate from tuberculous adenitis by the entire absence, in typical cases, of tubercle bacilli, whether on microscopic examination or by experimental inoculation. It also entirely differs from tuberculous adenitis. It is distinguished at once from leukemia by the examination of the blood, which shows no increase in the formation of leukocytes. It is also different from lymphosarcomatous tumors, for in it the enlarged glands do not implicate surrounding textures in their growth, nor show any true metastases, as do sarcomata. Another feature in Hodgkin's disease is that the enlargements, however great or widespread, remain individually discrete, not producing infiltrations anywhere. Another clinical feature is that the enlarged glands often, without any apparent reason, diminish in size to such an extent that they may temporarily, at least, seem to disappear. The only characteristic change has been found in the bone-marrow, which in some instances is altered into a rich lymphoid tissue. As in other affections of the blood-forming functions of the bone-marrow, its true nature and etiology are as yet unknown.

This affection occurs oftener in males than in females, and at various ages, but most commonly in adolescents. Its clinical features are that it begins with enlargement of the glands in one side of the neck, oftener the left. It may continue for an indefinite period before it involves the glands on the other side of the neck. From the neck it then proceeds to involve the thoracic glands, especially those in the mediastinum, more commonly than in the axilla. It may then appear in the groins, and meanwhile invade the lungs with lymphoid growths, also the liver, the spleen, and kidneys.

As it progresses, anemia becomes pronounced, though not so marked as in leukemia, the red corpuscles rarely falling below 2,000,000

per c.mm. One of the characteristic features of the disease is that its glandular enlargement often encroaches upon organs so as to interfere with their functions. I was once called in consultation by Dr. A. Monae Lesser for a supposed stricture of malignant disease of the esophagus, through which the doctor could not pass an esophageal tube. This diagnosis was rendered probable by the age of the patient, being sixty-seven, but, upon percussing his spine, I found an extensive area of dulness opposite the fourth and fifth dorsal vertebræ. I then asked the patient whether he could swallow liquids when he was lying down on his left side, whereupon he answered that he could. This proved that the pressure on the esophagus was outside that tube, and on further examination I soon found enlarged glands in his abdomen, and pronounced them a case of Hodgkin's disease, which diagnosis was subsequently verified at autopsy. These glandular enlargements go on increasing and causing the local disturbances with the functions of the intestine and other abdominal organs, until the patient sickens and dies from both anemia and emaciation. Fever is a common but irregular symptom of the disease, but only doubtfully connected with the disease process itself.

Histologically, the enlargements in Hodgkin's disease differ altogether from those in any other known complaint, and never show any tendency to implicate the surrounding textures in which they occur.

Treatment.—As to treatment, a good deal has been said in favor of the employment of the x-rays, which may diminish the size of the enlarged glands, but it is doubtful if any real cures have followed this measure. On the other hand, the administration of large doses of arsenic, beginning with 5 drops of Fowler's solution and increasing to 20, has been reported as actually curing the disease, though this is also doubtful. Phosphorus, in mineral form, may also be tried if the arsenic fails.

Recently Drs. C. H. Bunting and C. L. Yates, of the University of Wisconsin, claim to have discovered what they term a diphtheroid organism, and which they call *corynebacterium Hodgkini*, in the blood and tissues of patients with Hodgkin's disease. They were able to cultivate this organism and then inject the cultures into monkeys, with the result of producing typical glandular swellings in all respects corresponding to the enlargements in the axillæ and groins of Hodgkin's disease.

CHAPTER IV

DISEASES OF THE BONES AND JOINTS

CHRONIC FIBROSITIS, OR CHRONIC MUSCULAR RHEUMATISM

THIS affection occurs in persons past middle life, and prevails most among those who, like fishermen and sailors, are frequently exposed to cold and wet weather. It is not due to an inflammation, rheumatic or otherwise, of the muscles themselves, but rather to an inflammation of the fibrous sheaths of the muscles. These sheaths hold the different muscular bundles together, and in many respects bear the same relations to the muscles that the bark does to the tree, because both the blood-vessels and the nerves supplying the muscles must first traverse these sheaths. Fibrositis, therefore, is sure to occasion atrophy of the implicated muscles, as well as constant pain on movement. This is often strikingly exemplified in the wasting of the top of the shoulder when the deltoid muscle is involved in this affection; similarly, when the hip is separately attacked. As these fibrous sheaths end in tendons which are attached to bones, especially of joints, they become very tender, both to pressure and to movement, and thus cause serious crippling of the joints. It is customary to call this affection muscular rheumatism, but it does not respond at all to the ordinary remedies for rheumatism, such as the salicylates, etc. Like all inflammations which involve fibrous tissues, such as syphilitic periostitis, the patients are very susceptible to any lowering of the weight of the atmosphere, usually called "fall of the barometer," so that these patients have very sensitive barometers of their own which correctly inform them of the approach of a storm. The reason for this is that the nerves are closely bound to their fibrous surroundings, and are put upon a painful stretch such as cannot occur in soft tissues like those of the liver.

Treatment.—The main indication for treatment of fibrositis is to deal with its local manifestations by the best relaxant that we possess for muscles stiffened by any cause, namely, warm water. Douches of water at a temperature of from 95° to 98° F. on a badly stiffened shoulder, for example, used for twenty minutes three or four times a day will be sure not only to relax all the contracted muscles, but also

to restore the circulation, and thus the nutrition, of the part. Where muscles all over the body are affected these warm baths should be used, accompanied in every case, whether local or general, by active friction. As might be expected, no part of the body should be so carefully protected in this affection as the skin. The patient should never omit wearing flannel, and should sleep between blankets or flannel sheets, as the pains are very apt to be aggravated during the night. The skin should be rubbed on retiring with a lime-water liniment applied warm, and when the joints are especially involved the belladonna liniment is of great service.

Or the following liniment may be efficacious:

Liniment. aconiti	}ss ʒj;
Liniment. belladonnæ		
Liniment. chloroformi		
Menthol.....		ʒj.
Ft. liniment.		

Or,

Camphor.....	ʒiij;
Tincture of opium.....	ʒi.
Heat by putting bottle in warm water.	

Either of these can be applied warm.

By systematic attention to the above-mentioned measures the disease may be arrested. Otherwise the affection may progress from the implicated tendons at their attachments to the articular structures themselves, causing erosion of the cartilages, and changes in the synovial membranes, leading ultimately to permanent crippling of the joints.

ARTHROPATHIES

The textures which make up a joint are the least vascular of all tissues. Thus, the eye is an organ which contains within itself a representative of every tissue of the body except the reproductive tissues; and among them a most perfect example of what a cartilage is in the cornea, which does not even have a single capillary blood-vessel penetrated. The functions of joints also are chiefly mechanical, consisting of bones tipped with cartilage and enclosed in a bag called the synovial membrane, which secretes the synovial fluid for the purpose of lubricating the moving bony structures, and which also covers, for a certain distance, the tendons and ligaments of the joints. This bag is open at each end and is there attached to the bone. Being so

simple in its functions, arthritis or inflammation of joints is the least differentiated of all inflammations, their chief symptom being pain on movement of the part, so that we are little guided by the symptom pains in the etiology of the different forms. In one form, namely, gouty arthritis, we seem to have an example of what an insoluble ingredient in the blood (urate of soda) does when it circulates about such a non-vascular structure; for it is very apt to be arrested there and to produce inflammation by its presence, like any other foreign body. It, therefore, commonly begins with the most remote joint in the body, namely, the great toe. The other inflammations of joints are usually associated with microbic infections, such as the *Diplococcus rheumaticus* of Poynton and Payne, and the gonococcus, in so-called gonorrheal rheumatism, or it may be the pneumococcus or the agent of scarlatina; also in fibrositis, which is often named muscular rheumatism. In fact, the term, "rheumatism" is frequently applied to any affections of joints which have in common the symptom pains accompanying joint movement. A good example of this is in that chronic and severe disease commonly called rheumatoid arthritis, but better named arthritis deformans, which certainly has no rheumatic element about it, and in which all remedies for true rheumatic infections are of no avail.

ARTHRITIS DEFORMANS, OR RHEUMATOID ARTHRITIS

Arthritis deformans may be divided into two principal forms: one in which the soft tissue, such as the synovial membrane, becomes largely involved, with proliferation of its fringes and folds. The joint then may first be uniformly swollen and distended with the synovial fluid. Mechanical results, as it would seem, then follow from proliferation of the fringes of the synovial membrane which may greatly interfere with the articular movements, and soon lead to the destruction of the articular cartilages, so that the bony surfaces rub upon one another and become what is called eburnated, like surfaces of ivory. Ere long great deformity of the joint occurs, or even subluxation, from the unequal pull of the attached muscles. This is particularly illustrated in the distortion of the fingers, with which this disease often begins.

Etiology.—For a long time this joint disease was classed among the arthritic lesions, which undoubtedly occur in purely nervous diseases, such as tabes, but of late attention has been chiefly directed to supposed infections, in accordance with the frequent connections of different forms of arthritis with definite infections, analogous, as we have remarked, to rheumatic arthritis and arthritis by the gonococcus.

A diligent search, therefore, has been made for such infecting agents in this disease. Thus, Ballantyne, Poynton and Payne, Chauffard, and others have found organisms in the joints, and suggestive results have followed the injection of cultures in animals. The most probable deduction of this sort, however, is by Still, who observed in children not only the characteristic joint changes, but also enlargement of the lymphatic glands and of the spleen. A true demonstration, however, of the infecting agent or agents of this disease has not yet been accomplished, and we, therefore, must continue to treat of its morbid anatomy and its accompanying clinical symptoms. I much doubt whether those little hard knobs, so often found at the sides of distal phalanges in middle-aged women, called Heberden's nodes, have any connection with this disease.

A second form of this affection should be named *osteitis deformans*, for it is chiefly characterized by deformities and outgrowths connected with the bony structures of the joints. Owing to the multiform symptomatology according to the regions affected, many authorities divide this complaint into various forms, in my opinion unjustifiably, because it is really one disease in them all, whether it occurs in children or in old persons. When it involves the spine the intervertebral cartilages gradually disappear and bony outgrowths, in time, produce a virtual ankylosis, so that the whole spine becomes rigid as well as deformed, often with kyphosis. Not uncommonly the spinal nerves are pressed upon as they issue through the vertebral foramina, thus causing severe pain in their course, and hence, when the lower part of the spinal column is involved, they may give rise to sciatica. Meantime, certain other symptoms may develop very early, such as muscular wasting, which often seems independent of the joint or body derangements, and not secondary to want of use of the muscles. Subcutaneous fibroid nodules are occasionally met with, which should not be confounded with similar formations in acute rheumatism. All along the pulse is quickened, running from 90 to 110, a feature which is really diagnostic of the complaint.

Where many joints are affected the distribution is markedly symmetric. There is no affection which, in typical cases, is so distressingly crippling in its development. The patient may lie with the knees flexed on the thigh and the thigh on the abdomen, with similar distortions in the upper extremities. And yet, in some cases, the hands may be so free that the patient can sew or even write. The onset of this disease may be both acute and polyarthritic from the beginning, when it may be difficult to distinguish it from rheumatism,

the affected joints being both swollen and tender, but its subsequent intractable progress in time settles the diagnosis.

This disease occurs in both sexes, usually when above the twentieth year, though children may also be affected. A number of exciting causes, such as too frequent pregnancies or prolonged lactation, have been assigned, and in individual cases this may be true, but in the majority of instances no special cause can be given. Also in a great many of these patients decided remissions may occur from time to time.

Treatment.—This malady is almost invariably progressive and incurable. One case, a lady, wife of a physician, who had been pronounced as unmistakably affected by this complaint by a number of eminent medical men, was apparently cured by my systematically douching the throat night and morning. She seemed to be so well that she omitted these douches for a few months, and then relapsed, to be again relieved on resuming this treatment. But it must be confessed that our only hope lies in the direction of the identification of a specific microbe as its cause, thus enabling us to treat it with its own vaccine.

OSTEOMALACIA, OR FRAGILITAS OSSIUM

I have seen but one case of this rare disease, in a middle-aged lady who had apparently one hundred spontaneous fractures, some of which occurred from simply turning in bed. These fractures seemed to heal rapidly, without inflammation or pain. This patient, however, survived the onset of the complaint only two years.

Its etiology is altogether obscure. Theoretically, it might be benefited by an administration of 20 gr. of lactate of calcium four times a day, and by $\frac{1}{50}$ -gr. pills of mineral phosphorus three times a day.

PULMONARY OSTEO-ARTHROPATHY

This very obscure disease begins with a clubbing of the fingers and toes, by which is meant changes in shape of those parts, consisting of enlargement of the nails, both longitudinally and transversely. This must be distinguished from the clubbing of the fingers occurring, often limited to one hand, in the course of a chronic pulmonary disease, as in phthisis, and in some cases of heart disease due to venous engorgement. In conditions that interfere with the circulation, clubbing may follow and be unilateral or bilateral, in order to belong to the general systemic affection called pulmonary osteo-arthritis. Besides the initiative clubbing of the fingers and toes, there are changes in the bones and joints not unlike those occurring in acromegaly,

but different from that disease in that the bones of the face are not involved, the changes being limited to the enlargement of the hands and feet, and of the ends of the long bones, chiefly of the lower three-quarters of the forearm, and legs.

But the special feature of this obscure disease is its usual association with disorders of the lungs or of their appendages, such as chronic bronchitis, bronchiectasis, pulmonary phthisis or chronic pleuritis, and notably empyema. Take it all in all, the pathology of this complaint is very obscure, because its manifestations are so numerous and different that it must be due to a widespread nutritional disorder of unknown origin.

PHOSPHORUS NECROSIS

A specific disease of the jaw-bone was formerly often mentioned as occurring among workmen in match factories, where they were exposed to the fumes of phosphorus. In nearly all cases reported the disease began in roots of decayed teeth and then spread to the jaw-bone, itself producing a necrosis of the bone and, consequently, ulceration of both the tissue and the adjacent parts. This led to enactments of law to protect the workmen from this danger which have greatly lessened its occurrence. This good result may also be due to modern changes in the manufacture of matches, particularly in the case of the safety matches, which can only be lit by being struck against a specially prepared surface.

CHAPTER V

DISEASES OF THE RESPIRATORY TRACT

THE respiratory tract begins in the nose and continues into the larynx, and from there, through the trachea to the bronchi. On its way it crosses the alimentary tract, which begins in the mouth. No contrast could be greater than between these two tracts, in one respect. The respiratory tract is the only portion of the body which, in health, is quite sterile, that is, practically free from micro-organisms, as micro-organisms are filtered out from the inspired air by the hairs which line the entrance of the nostrils. On this account, when any accident causes a perforation through the bronchial tract into the lung tissue, no abscess is then formed in the lung. This is one reason that Calmette's theory is so probable, that we contract tuberculosis, not through the air which we breathe, but by what we swallow. One exception to the foregoing is in the case of the virus of poliomyelitis, which modern researches conclusively prove to enter through the upper nasal passages, but the virus of poliomyelitis is so minute in size as to be ultramicroscopic, and hence may escape the hairy filter in the nostrils. Fine mineral particles, as in the case of stone-cutters and coal-miners, become lodged in the air-vesicles, but it is certain that they do so by means of inhalation through the mouth.

In the case of coal-miners and other workers in a dusty atmosphere the walls of the air-vesicles may be actually blackened by the deposit in them of the particles inhaled, to which condition the term "pneumo-koniosis" has been applied, but it is extraordinary how little trouble these deposits occasion until we meet with fine particles of hard silex inhaled by stone-cutters while at their trade, or powders of steel breathed in by knife-grinders. In both these cases chronic inflammatory changes in the walls of the air-vesicles are set up which afford a favorable soil in which tubercle bacilli grow, thus causing stone-cutters' and knife-grinders' phthisis.

Another clinical fact is also significant, and that is, although the bronchial tract may be bathed with the most abundant or even putrid secretions, the general system does not suffer from the absorption of such injurious materials into the blood, as it certainly would if they were in contact with any other mucous membrane. Thus a

bronchiectatic cavity, however large, may be emptied once or twice a day by coughing out the very offensive contents, without accompanying systemic symptoms.

THE NOSE

It is a general physiologic law that the innervation of each inlet in the body to a tract is associated with the normal functions of such a tract. This is strikingly illustrated in the case of the nostrils and their contiguous nasal passages. The respiratory tract begins with the nostril and the nose, and any form of nasal obstruction may seriously affect the functions of the bronchi further on. On that account such physical obstructions as nasal polypi may have direct relations to the irregular actions of the bronchi, setting up the disorder called asthma, in the same way as obstructions at the outlet of the urethra may produce widespread disturbances of the innervation of the genito-urinary tract.

CORYZA

It is in affections of the respiratory tract that the principles laid down in our first chapter, on "Catching Cold," have their most striking illustrations. Thus, acute coryza, while it may begin from wetting of the feet, is ordinarily caused by a draft of cold air on that great center of vasomotor association, the nape of the neck. When at all severe the whole nasal mucous membrane, as well as those of the supra-orbital canals, become first congested, and then affected with typical catarrhal inflammations. Its initial starting from a cutaneous area is then shown by the widespread sensitiveness of the skin, which sometimes follows so markedly that the patients are aware of a cold draft from an open door, which would not be perceived by any person in a normal condition. This susceptibility may, by repeated attacks, end in chronic catarrhal inflammations of the nose, one of the miseries so often brought to the notice of rhinologists.

Treatment.—Proper treatment of these patients, therefore, is to apply cold sponges or douches to the nape of the neck twice or three times a day, while locally insufflations of 8 gr. of aristol in 2 drams of bismuth may be tried. Cocain and adrenalin may also be used as adjuvants, but their action is too temporary to relieve any settled catarrhal inflammation, which may be far better treated by the tonic applications of cold to the nape of the neck. In many cases of long-standing nasal catarrh the Eustachian tubes also become involved, with production of tinnitus and deafness, which may be relieved by dealing only with the original nasal congestion. Medicinally, especially at the be-

ginning of acute coryza, a dose at night of two of my grip pills is often effective. (See Influenza.)

In other cases, similar to its good effects in acute bronchitis, 10 gr. of urotropin combined with 10 gr. of sodium benzoate are often helpful.

It is a good example how the different parts of every mucous tract are affected by conditions found in the beginning of those tracts, that chronic laryngitis is often promptly relieved by the removal of a nasal polypus, or by the correction of a similar obstruction to the passage of air in respiration.

EPISTAXIS

Epistaxis, or nosebleed, may be due either to local causes in the mucous membrane of the nose or to conditions of the blood itself. One of the severest cases in my experience was in a young man who has been long subject to severe ague, with enlarged liver and spleen. It is also frequent in anemias due to constitutional conditions, such as in leukemia or in purpura. It is particularly frequent in the onset of typhoid fever, and is then diagnostic. When due to local causes it is usually trivial, but it should be remembered that the veins of the nasal passages lie in bony canals, and hence, if they begin to bleed they are not easily stopped unless the mucous membrane itself is made to contract upon them. Epistaxis occurs spontaneously in young persons about the age of puberty, particularly in families characterized by collections of small stellate looking veins radiating from one center on the skin. These hemorrhages usually are trivial and cease spontaneously, but the tendency to them is best checked by applying cold to the nape of the neck, as directed in the Treatment of Coryza.

When due, however, to conditions of the blood and not to local causes, they should then be treated accordingly. One of my worst cases occurred in a child after nasal diphtheria. In this case the blood trickled down the posterior nares into the stomach, and was then vomited in large quantities, which might easily have been confounded with hematemesis; in other cases the blood may be coughed up and thus simulate hemoptysis.

When due to conditions of the blood itself, these have to be treated according to their causes. Thus, in malaria, the administration of quinin along with 2 teaspoonfuls of paregoric may be the most effective, while arsenic should be given in leukemia. The best local remedy is by spraying the nose every fifteen minutes with a solution of adrenalin. In some severe cases, however, if doses of 15 gr. of the chlorid of calcium every three hours are not sufficient, the nostril should be plugged from behind, as directed in books of surgery.

ASTHMA

This is an affection characterized by disturbance in the natural rhythm of the two acts in breathing, namely, inspiration and expiration. In health, expiration begins immediately with the end of inspiration, but in asthma, while the inspiration is not interfered with, difficulty occurs in the act of expiration, making the latter prolonged and labored.

Asthma may be, though rarely, primary. Such a case I once had in a patient who was over seventy years of age, and who said that he had been born asthmatic. But in the majority of cases asthma is caused by interruption in the act of expiration from coughing. The act of coughing can occur only in expiration, and hence prolonged coughing from any cause may first originate asthmatic breathing. Thus, in children, asthma frequently supervenes, and may last for life from attacks of measles or whooping-cough. From this it is evident that chronic bronchitis is very apt to cause asthmatic attacks. This being so, it becomes a practical question to decide whether the asthmatic disorder is due to bronchitis or whether it occurs without bronchitis, because in the first case we should aim to cure the bronchitis, for then the asthmatic breathing will cease of itself. On the other hand, we may have the asthmatic disorder without its being preceded by any bronchitis. In such case of primary asthma the affection is a pure neurosis involving the nerves supplying the bronchial muscles, and must be treated as a neurosis.

The mechanism of an asthmatic attack should be clearly understood. From the difficulty of expiration the residual air in the lungs constantly increases, with the result that the air-vesicles become over-distended and the whole chest seems to contain too much air. The diaphragm is pushed down and the ribs move but little in outward expansion during inspiration. The breathing then becomes mainly vertical or directly up and down. On percussion the note is everywhere clear, and the inflated lung overlaps the natural area of percussion dullness over the heart. It is, however, on auscultation that the most characteristic signs are elicited. In cases of pure asthma, whistling sounds, called sibilant râles, are everywhere present and wholly displace normal vascular breathing. If there is bronchitis also present, we have a great variety of sounds, some cooing, others crackling, or even groaning, according to the size of the bronchial tube in which they occur. Meantime the aspect and the movements of the patient become characteristic. His whole frame partakes in the struggle for air, which leads him voluntarily to try to expand the chest yet more

and more. He strives to make his back, shoulders, and head immovable, so that from them the accessory muscles of respiration may pull upon the already tense walls of the thorax. Hence, he fixes his arms or plants his elbows on a table or other support, while his head is thrown back, his mouth panting, his eyes widely open and fixed, and his face pale and bedewed with perspiration. He speaks only in monosyllables, and resents everything which calls him off, even for a moment, from his efforts to breathe. The pulse grows small and feeble, and the patient becomes so cyanotic and cold that his wet, clammy skin and ghastly expression are apt to inspire strangers with fear of his near dissolution.

The duration of an attack varies greatly, not only in different patients, but in the same patient at different times. The attack may come on in the night and pass off soon after daylight, or it may be prolonged into a series of exacerbations and incomplete remissions for several successive days and nights, until the sufferer becomes almost fatally exhausted. In like manner, the subsidence bears little relation to the severity or duration of the attack. Either as the effect of remedies or spontaneously, the breathing may become suddenly easier, the rigidity of the chest walls passes off, the inspirations grow fuller and the expirations shorter, and the patient, who but a few moments before seemed about to perish in his distress, will soon return, after a moderate expectoration of a clear frothy mucus, to regular and natural breathing, with no other indications of his recent sufferings than an expression of fatigue. At other times, especially if bronchitis supervenes, the attack passes off in a series of irregular paroxysms of difficult breathing, alternating with coughing and free expectoration. In many fully developed attacks, however, the patient has to watch carefully for its decline and guard against all causes of exacerbation or relapse, particularly from eating, so that some asthmatics are obliged to go to bed fasting if they are to pass that night free from dyspnea.

Etiology.—The exciting causes which will develop an attack in asthmatics are extremely varied, because there is no tract the nerves of whose mucous membrane are so sensitive as that of the respiratory tract. Thus, the nasal mucous membrane is often the seat of abnormal excitability, as we might expect from the general law already alluded to, that the outlet of any tubular structure is always closely associated in its nerves with the tract itself to which it belongs.

In every asthmatic, therefore, the nose should be carefully examined, because many old cases of the disease have been cured by the

removal of nasal polypi, or by operations which rectify abnormalities in the nasal passages.

Strong odors of any kind are mentioned as exciting causes in such patients, not excluding the pleasant fragrance of violets. The most pronounced cases, however, are reported as due to the odors of animals, so that we hear of cat asthma, or, similarly, from the odor of horses, and particularly the various sources of such excitations in menageries. I knew of one case in which a man insisted that a cat was in the room, because nothing else could so effect him, for he trembled all over, and after a diligent search the cat was found hidden behind a sofa.

Next to the respiratory tract, the most frequent excitants of asthmatic attacks proceed from the alimentary canal, particularly from the stomach and duodenum, and receive the general designation of "peptic asthma." Partaking of too hearty a meal, especially in the evening, is apt to induce an attack in the following night. Many asthmatics are unable to eat freely except in the morning or at noon. In other cases susceptibility is limited to only certain articles of food, which for them are always interdicted. One of the commonest of these is cheese. With susceptible people mere change in the rate of breathing will suffice to develop an attack. Thus, during sleep the breathing is much slower, and this change is enough to cause nearly all asthmatics to have their attacks come on after midnight.

True asthma is a disease *sui generis*, but is often imitated by the effects of toxemia such as in gout and in uremia. But in both these cases there is a significant difference. However severe an attack of true asthma may be, even so that the patient seems on the point of dissolution, he is not alarmed; but in uremia he often is so, early in its onset. In the gouty cases the attacks are sudden, nocturnal, and quickly accompanied by a great bronchial flux which may be pinkish from capillary hemorrhage. A patient of mine once expectorated two large basinfuls of such mucus between midnight and morning, but after three such attacks they ceased and never recurred.

Asthma may begin at any age, as in the case already referred to in which the patient was born asthmatic. As to sex, there is an apparent preponderance of males, which is explained by their liability to bronchitis from outdoor exposure. If the disease supervenes in childhood, as from attacks of measles or whooping-cough, the prognosis is rather favorable that they will outgrow it after puberty.

There are no primary organic lesions characteristic of asthma, but such lesions when secondary are not uncommon. In some cases chronic bronchitis is responsible for the changes found both in the

lung texture and in the bronchial tubes, those lesions being in the form of emphysema and dilatation of the right chambers of the heart, with their consequent derangements described under Chronic Bronchitis. Lastly, from the combined derangement of the pulmonary circulation caused by the intermittent apnea and the permanent emphysema, we have a tendency to bronchial flux to relieve the congested vessels, which finally adds chronic inflammation to chronic hyperemia, and thus establishes the vicious circle of impeded circulation causing bronchitis, and bronchitis, in turn, causing progressive circulatory impediment.

These slowly induced effects finally produce changes of personal appearance which mark old asthmatics. As the general nutrition suffers from the persistent congestion of the liver caused by the impeded outflow of the right heart, these patients are usually thin, pale or cyanotic, and with deficient muscular power. The eyes are prominent and watery, the voice is weak, the gait slow and measured, and the back rounded, often to great deformity. The head, however, is always thrown back between the elevated shoulders, and the trunk of the body is kept so rigid that the arms hang passively, swung by the movements of walking.

Theories about the actual conditions present in an attack of asthma are somewhat discordant. Many ascribe the symptoms to be altogether due to spasm of the muscles of the finer bronchi, but this does not account for the absence of difficulty during inspiration. Another view is that asthma is due to implication of the phrenic nerve, which causes a tonic cramp of the diaphragm. This theory accounts for nearly all the symptoms of asthma, but leaves some unexplained, particularly those of bronchial asthma.

Treatment.—The treatment of asthma varies according to the aim in view. If the aim be to relieve the distressing dyspnea, we may have a great variety of remedies which will relieve the symptom spasm, but not cure the disease asthma. Thus the different members of the class remedies called Solanaceæ, namely, belladonna, hyoscyamus, stramonium, and duboisia, are each effective and seem to relieve the paroxysms immediately. Many asthmatics, therefore, can cut short for years the asthmatic spasm by the inhalation of the smoke of burning stramonium leaves, but they simply relieve the symptom spasm and do not cure the disease asthma, nor lessen the frequency of the attacks. The only true remedies for asthma are arsenic and iodine, but, as we have remarked in our article on Remedies, the agents which prominently relieve the disease may be helped in their action by the simultaneous administration of the remedies which relieve the symp-

toms. My common prescription, therefore, for the treatment of asthma is:

R. Potass. iodid..... 3iss;
 Liq. potas arsen..... 3j;
 Spts. eth. sulph. co..... 3iiss;
 Tinct. belladonnæ..... 3ij;
 Syr. aurant. cort..... ad. 3vj.—M.

Sig.—Two teaspoonfuls in water an hour after meals.

Belladonna is introduced because it is in the same botanical family as stramonium. The active principle of belladonna or atropin is often effective when given hypodermically at the nape of the neck in a dose of $\frac{1}{100}$ to $\frac{1}{75}$ gr.

We have already stated that when asthma supervenes upon chronic bronchitis, treatment of the bronchitis should take the lead. It was for a distressing case of asthmatic attacks occurring in a patient who had chronic bronchitis that I first had recourse to the emulsion of linseed oil for the treatment of this disorder, as fully detailed in the article on Bronchitis, and after many years of experience with this remedy I have found no treatment equal to its systematic administration in cases of true bronchitic asthma.

In conclusion, we may say that no chronic asthmatic should ever take a dose of diphtheria antitoxin as usually administered, for a number of cases have been reported of such patients quickly succumbing with very serious symptoms, both cerebral and respiratory. These untoward results are ascribed to anaphylaxis, but why they should occur in asthmatics and not in ordinary patients with other diseases cannot be explained, because the subject of anaphylaxis itself is one of the most obscure in medicine.

HAY-FEVER

Hay-fever or hay-asthma prevails most among those who live in cities, and who have nothing to do with hay. In New York it is remarkably characterized by its supervision on the 20th day of August, so that patients who would leave the city before that day by going to sea or to certain localities were always free from the disease. Gentlemen have come to me because this annual visitation occurred when the dry goods trade was at its height and thus entailed upon them serious inconvenience. I have told them that in three years they might be rendered immune from the attack by commencing in June with a prescription of tincture of belladonna, 3 drams, and Fowler's solution of arsenic, 9 drams, 12 drops of this mixture three times

a day, taken until the usual advent of the disease in August; the result being that in the first year of this medication the attack would be much milder; in the second year, milder still; while in the third year it would be scarcely perceptible.

There can be no doubt that the habits of life have much to do with the susceptibility of persons to this common complaint. I have no doubt that this affection is much more common now than it was in the days of our forefathers, and this has suggested to me the surmise that it may be due to the irritating effects on the nasal passages of the use of illuminating gas in our houses. It is not by any means true that farmers who have to reap hay and rye are so prone as city-bred people to this complaint. Farmers also all over the northern states cultivate buckwheat, whose odors are notoriously prone to irritate the respiratory passages.

I know of a patient who always could tell instantly when buckwheat flour was brought into the house, though he might be up on the top floor, by the supervention in him of asthmatic breathing.

There can be no doubt that, as Dunbar has shown, this affection is produced by the prevalence in the atmosphere of pollen from a variety of grasses, particularly rye, and, as we have remarked, buckwheat. But that does not account for the absence of hay-asthma in many places, such as in Bethlehem, N. H., where many persons resort each year to escape this trouble. In the Adirondacks, also, it may be due to the absence of cultivated crops of the various grains.

Symptoms.—The symptoms of this complaint usually begin much as a cold in the head, with sneezing, watering of the eyes, and some sensations in the supra-orbital sinuses; in many cases this is accompanied by slight fever; if not, with the general symptoms of having caught a bad cold; ere long, also, the lower respiratory passages become affected with symptoms of bronchitis, ending in many cases with actual signs of asthmatic breathing. The patients become very susceptible to all drafts of cold air, evidenced every now and then by an apparent relapse of the complaint. Usually the attack declines in about ten days, but in some cases it hangs on, as a wheezing bronchitis, for three weeks, if not more. The appetite is lost and occasionally digestive disorders supervene. I have found that the continuous use of the belladonna and arsenic prescription, above given, seems to shorten the disease more than the usual remedies for ordinary bronchitis.

A milder affection is also commonly called the "rose cold," which comes on in June, and, on account of its occurring when rose blossoms are most numerous, it is ascribed to the inhalation of their fragrance.

I had a patient once who was very subject to disturbances of an asthmatic effect if he smelt very fragrant roses, but it is more probable that it is due to the pollen of grasses, as in the case of the disorder in the later months of the summer. It is not uncommon, however, for those who are subject to rose cold to be affected by the later August complaint.

ACUTE LARYNGITIS

Laryngitis, as a primary affection, is unknown, being rather due to the extension downward of a "cold" in the head; its first symptom is hoarseness, from swelling of the mucous membrane of the vocal chords. If at all severe, it is soon accompanied by sore throat, and at first by a dry, croupy cough. If it further progresses, there is aphonia, or loss of voice. These symptoms are familiar to everyone from what is popularly termed "catching cold in the throat." The practical aim now is to prevent the laryngitis from becoming chronic and from progressing further downward to the bronchi.

It is quite otherwise when any part of the larynx is invaded by extension of any morbid process occurring in parts contiguous to the breathing apparatus, for then the laryngeal affection may soon become dangerous to life. This happens in all membranous exudations which invade the larynx, illustrated particularly in laryngeal diphtheria. No such processes are apt to remain confined to the larynx, but spread by contiguity to the trachea and bronchi, as we have already mentioned in speaking of laryngeal diphtheria.

We have referred in our article on Erysipelas to the dangerous supervention of edema of the glottis when erysipelas attacks the throat. This complication should also be watched for in cases of small-pox developing in the mouth.

Treatment.—We have also alluded to the distressing laryngitis which occurs in pulmonary tuberculosis. When the larynx is affected in the course of any disease, particularly in diphtheria, the patient should be placed under a tent, which is conveniently made by suspending an open umbrella over the bed, to which sheets should be attached. Then a stream of vapor from a kettle of boiling water, to which one-third of syrup molasses is added,—the vapor of the syrup itself being quite soothing to the mucous membrane of the larynx and trachea,—is led into this tent. The stream is to be conducted from the mouth of the kettle in a large tube, of the size of the arm, made of paper lined with oiled silk, because inhalation of steam directly from the kettle is scalding; our object being rather to fill the whole

tent with the vapor of the boiling water. Nothing, in fact, is so soothing to the inflamed laryngeal membrane as this steam vapor.

In all cases of chronic laryngitis the throat ought to be douched twice a day with hot water, in the fashion recommended in our article on Scarlatina and Diphtheria.

EDEMA OF THE GLOTTIS

This is the most rapidly fatal of all affections of the respiratory tract. At one time I was detained only a few minutes from visiting one of my small-pox wards, only to find on my return that a patient with confluent small-pox which had invaded the mouth was dead from a sudden development of edema of the glottis. This accident is also to be especially dreaded when erysipelas of the face extends to the mouth, but it may unexpectedly occur also in any one of the exanthemata. The diagnosis of its approaching onset is comparatively easy, for not only may a greatly swollen epiglottis be readily seen by the laryngoscope, but may be felt by the finger, or actually be seen rising at the base of the tongue. No time should be lost then to scarify the swollen contiguous structures by a long scalpel, and, if this measure does not furnish relief, to perform tracheotomy without delay, for only thus may it be possible to save life.

CHRONIC LARYNGITIS

Chronic laryngitis is usually caused by repeated attacks of acute laryngitis, although it may occur as an independent affection in persons who customarily strain the voice in public singing or speaking. I once relieved a professional singer, who greatly dreaded attacks of failure of her voice, by having her suck through a tube equal parts of hot milk and lime-water in small quantities for over an hour at night. She told me afterward that this procedure saved her from retiring from her business.

A form of chronic laryngitis occurs so often in public speakers as to go by the name of "clergyman's sore throat." An examination of the throats of these patients shows that it is almost invariably accompanied by chronic laryngitis as well, and is best treated first by rest and by douching the throat with hot water and chlorate of potash, in the manner spoken of in the treatment of scarlatinal sore throat.

TUBERCULAR LARYNGITIS

This affection may be termed the most distressing of the many miseries caused by tuberculosis. In the majority of cases it is second-

ary to tuberculosis of the lung, and by the laryngoscope the vocal chord corresponding to a cavity or extensive tuberculous disorganization in the lung is shown to have been affected by being constantly bathed with the infected sputum from that lung. In other and the worst cases, however, it occurs early, while only a moderate focus of tuberculosis is present in the lung. Why the ulcerative process of the chords in these cases is so serious is not easily explained. Not only are the vocal chords involved, but the glottis itself, with the epiglottis, may be fairly burrowed by ulcerative tracts. Deglutition, therefore, becomes very painful, and, in bad cases, accompanied by regurgitation into the nose. The nutrition of the patients suffers extremely, as they dread all acts of swallowing.

Treatment.—Much the best treatment of this affection is to apply powdered opium, 1 part, and powdered bismuth, 4 parts, on a swab, directly to the glottis. A 4 per cent. solution of cocain may also be used as a local spray.

LARYNGISMUS STRIDULUS, OR SPASMODIC CROUP

This affection occurs often in infancy, but is always alarming in the symptoms. A child goes to bed apparently quite well, but is awakened in the night by a spasmodic affection of the vocal chords, accompanied by a brassy cough and high-pitched stridor in breathing. This may or may not be preceded by symptoms of slight cough; it may set in, however, from irritation produced by undigested food. It subsides quickly upon the action of an emetic, such as 1 to 2 teaspoonfuls of the syrup of ipecac. As a prophylactic to these attacks we should use cold water sponging at the nape of the neck and the front of the chest, followed by active friction.

When these attacks occur frequently it is a sign of general constitutional debility, for which nothing is better than cod-liver oil.

BRONCHITIS

It is noteworthy how very rarely bronchitis is caused by the nature of the air which we breathe. If that air contains any irritating substances, it is stopped by spasm and coughing in the larynx. Instead, as we have remarked in our first chapter, bronchitis comes from the skin, which has to be attended to first in all victims of chronic bronchitis. Clinically, bronchitis may be divided into two forms, acute and chronic. It also differs altogether from pleurisy and pneumonia by being bilateral. Hence, whenever severe, the patient cannot lie down, but must sit up. Both nostrils are widely dilated, and the mouth

is never tightly closed, but the lips are partially open. The lips are not drawn tightly across the upper teeth except in case of pain. At first acute bronchitis may be quite dry of secretion in the bronchial tubes, but the mucous membranes are then much tumefied, and their lumen so narrowed that the dyspnea and cyanosis may be pronounced. Auscultation will reveal universal fine sibilant râles both anteriorly and posteriorly. The indication now is to promote secretion, for that will reduce the tumefaction of the bronchial mucous membrane and bring on cough with expectoration. The best remedy for this state is tartar emetic, 1 gr. of which should be dissolved in a teacupful of water, 1 teaspoonful of which may be taken every ten minutes until nausea sets in, when the symptoms at once become modified, with cough and expectoration.

Symptoms.—Ordinarily, acute bronchitis begins with signs of inflammation of the bronchial tubes, with both pain and cough. The pain has no resemblance to that of acute pleurisy or of pneumonia, but is rather a sense of diffused soreness through the chest, graphically denoted by the gesture of the patient, who passes his whole hand over the front of his chest. Dyspnea also persists for some time from the initial swellings, which we have already described. This dyspnea is modified by more abundant secretion along with coughing. The physical signs then are of distention of the whole thorax. The percussion-note is everywhere resonant, but it is then that the signs of auscultation are the most characteristic. All over the chest both sibilant and crackling sounds are heard, sibilant with wheezing where bronchial spasm predominates, and crackling in proportion to the secretion. These crackling sounds are audible both on inspiration and expiration. The cough also has a very characteristic sound, which the clinician should note. In proportion as the cough is squeaky in character and accompanied with wheezing, it denotes more or less asthmatic spasm of the bronchial tubes, and viscosity of the secretion. As it becomes more liquid, the spasmodic element diminishes, and the râles become more pronounced, indicating that the expectoration is now more free. Meantime what is expectorated is less mucoid and begins to show the admixture of pus. The temperature of acute bronchitis is relatively low, not often reaching 103° F.

Treatment.—The indications for treatment are to cause the secretion to be as liquid as possible. It is only when the secretion is glairy and viscid that the cough is so tight. We have an illustration in hemoptysis of how easily the bronchial tubes may be cleared of purely fluid contents, for then the blood is often raised so readily that the

patients are not sure whether it comes from the bronchial tubes or from the throat. The indication, therefore, for the treatment of the cough of bronchitis is to give medicines which promote the free flow of the secretions, combined with nervines which allay the spasm. For the first indication more or less nauseant expectorants are often prescribed, such as ipecacuanha and syrup of squills. Preparations of ammonia, especially the chlorid, are often prescribed to promote expectoration. Tartar emetic is not often given at present on account of its depressing effects, except in the manner above mentioned during the dry acute stage. The real remedies, however, are oils, of which, as we have mentioned, linseed oil is the best, given in the following formulas:

LINOGEN (PLAIN)

Irish moss.....	1 ounce;
Marshmallow root.....	2 ounces;
Aqua.....	3 pints.
Boiled one-half hour; strain to 3 pints.	
Add linseed oil (15 ounces) to make emulsion.	
Oil of wintergreen.....	2 drams;
Oil of cassia.....	2 drams;
Glycerin.....	5 ounces;
Simple syrup.....	10 ounces;
Dilute hydrocyanic acid.....	160 minims (1 minim to each tablespoonful).

LINOGEN (COMPOUND)

Irish moss.....	1 ounce;
Marshmallow root.....	2 ounces;
Aqua.....	3 pints.
Boiled one-half hour; strain to 3 pints.	
Add linseed oil (15 ounces) to make emulsion.	
Oil of wintergreen.....	2 drams;
Oil of cassia.....	2 drams;
Glycerin.....	5 ounces;
Simple syrup.....	10 ounces;
Dilute hydrocyanic acid.....	160 minims (1 minim to each tablespoonful);
Chloral hydrate.....	15 grains;
Magendie's solution.....	5 minims to each ounce.

I have rarely found an attack of acute bronchitis which is not relieved within forty-eight hours by this remedy.

We would now refer to the mechanical effects of the presence of secretion in the bronchial tubes. No secretion of any kind should be allowed to remain in them, for their natural function is to contain nothing but air. Hence, for purely mechanical reasons, the continuance of bronchial secretions in the air-tubes may be the cause of death. This, as we have explained in our first chapter, is the great peril of bronchitis in infants, on account of their very feeble powers of expecto-

ration; also for the same reason in bronchitis of the aged. We need not, therefore, repeat what we have said on this subject in the first chapter, and pass on to chronic bronchitis.

This affection commonly results from neglect to cure acute bronchitis, attacks of which recur again and again, until it becomes a settled disease. The primary origin, however, of bronchitis from the skin is frequently illustrated in these patients by their improvement during the hot summer months. Gradually, however, the freedom from the attacks in summer grows shorter until the disease becomes settled by the operation of causes which constitute a vicious circle, because the constant coughing in time produces that overdistention of the air-vesicles which is termed "emphysema."

For every case of chronic bronchitis, therefore, special measures should be taken for protection of the skin, for which there is nothing better than a suit of perforated chamois skin for both the upper and lower extremities. A light underwear of cotton flannel should be put on first, while the chamois skin is to be worn only in the daytime, but not at night. At night the head should be protected by something light like a flannel shawl, whose ends are pinned under the chin, while the rest of the shawl drops over the nape of the neck. The principal importance of these details is shown by the frequency with which colds are contracted at night in bed rather than while one is going about in the daytime, and the old-fashioned night cap which our ancestors wore has much to recommend it.

Emphysema, in turn, greatly interferes with the free circulation of the blood in the lungs, entailing dilatation and weakness of the right cavities of the heart. This necessarily leads to passive congestion of the lungs, particularly at their bases, finally establishing a condition in which more cough causes more pulmonary weakness, and thus the congestion, which leads to continuous secretion in the bronchial tubes, must be coughed up. In the bronchitis of the aged, therefore, we often meet with excessive secretion, when the indication is to directly diminish the bronchorrhea. For this purpose nitric acid combined with moderate doses of tincture of belladonna may be used, while the heart is to be strengthened by full doses of tincture of chlorid of iron with *nux vomica*.

FIBRINOUS BRONCHITIS

This affection is strange, in that, unlike bronchitis, it is limited in its extent to only a single, but moderately sized, bronchus, with its branches. There is no accounting for it, because if it were anything

like a general affection of the bronchi, we might at any time be suffocated by its occurrence. It is characterized by the formation of exudations in the affected bronchus, which are mistakenly called fibrinous casts, for, instead of being fibrinous, the casts are really composed of membranous mucin. It is a rare affection, for I have seen only 2 cases of it, but they were typical, consisting of white casts, not dissimilar from those which are coughed up when diphtheria extends its membranous exudation into the bronchi. It is, however, totally different from diphtheria, both in its antecedents and its consequences.

Ordinarily it sets in suddenly, with an attack of severe coughing and dyspnea which continues until the cast is expectorated, when it may be found to consist of a perfect membrane which had lined the bronchial tube.

It may occur in an acute form during the course of typhoid fever, or even in croupous pneumonia, when, however, the casts are not long. Occasionally it occurs in the course of pulmonary phthisis, but in neither of these affections has it anything like the length or extent of what we must still call the idiopathic form. In some patients the attacks may occur at intervals for years, but are not at all like the fatal forms coming on during the specific fevers.

Physical examination of the lung shows no signs of extensive bronchitis, the findings being localized in the affected bronchus itself, where there may be an area of suppressed breathing, with perhaps a few râles, caused by a single piece of the exudation vibrating in the current of air of the tube to which it is attached. Otherwise there seems to be suppressed breathing in the neighborhood.

As to **treatment**, the inhalation of steam from vaporized lime-water, combined with emetics, is the most successful.

BRONCHOPNEUMONIA

This fatal disease is responsible for the great mortality in cold and temperate climates, following measles and whooping-cough in children, so that nowadays, instead of the term "capillary bronchitis," a more accurate name, "bronchopneumonia," is given to this affection. We have already, in our chapter on "Catching Cold," spoken of the disastrous results to pulmonary texture of the processes which occur in bronchopneumonia. Instead of the complete absorption of the exudation into the air-vesicles of croupous pneumonia, the exudation into the vesicles in bronchopneumonia soon involves the walls of the vesicles, and extends into the interlobular tissue, simply because we have conditions exactly simulating the ruinous textural changes that occur

throughout a whole lobe of a lung whose main bronchus has been plugged by the accidental lodgment of a foreign body.

In addition to the exudation into the air-vesicles of mucopus, the lung presents, on its surface, numerous little depressions, which are due to collapse of the air-vesicles, by a mechanism which we have already described, and finally the extensive injury to lung tissue allows all sorts of bacterial invasions to occur, in the later stages including that of tuberculosis itself. Bronchopneumonia, therefore, from its origin in bronchitis, is a bilateral affection, and far more common in children than in adults, whose secretions in bronchitis are readily expectorated.

Symptoms.—The first clinical sign to make its appearance, which should always be of serious import, is a sudden rise in temperature, for that means the supervention of pneumonia upon bronchitis. The physical signs are very uncertain, consisting of scattered areas of dullness on percussion, contiguous with the limited areas of a clear percussion, while analogous phenomena appear on auscultation, in small areas, of harsh bronchial breathing, with fine sibilant râles occurring immediately adjacent to the areas of suppression.

Treatment.—In infants we have only one measure which we can substitute for the deficient powers of expectoration, and that is emetics. As the action of emetics here is purely mechanical, nauseant emetics are contra-indicated, and a full dose of 5 gr. of the sulphate of zinc, or a desertspoonful of the wine of ipecac, should be given. The patient should not be left lying in bed, but should be raised, so that the head hangs down as soon as the child tries to vomit. The fingers, also, should be introduced into the mouth, so as to take hold of the long strings of expectoration, and thus mechanically assist the process of getting rid of mucus. It is often surprising how effective these measures appear to be, and the patient, who is on the verge of suffocation, commences to breathe freely after having got rid of the tough accumulations in its trachea. As soon as the stomach is quiet the infant should be made to swallow teaspoonful doses of hot milk and lime-water, given every five minutes or oftener, on account of the intimate association between the acts of swallowing, and the beat of the heart, brilliantly demonstrated by Kroenacker, who showed that every act of swallowing stimulates the cardiac systole. Even in adults the swallowing of hot drinks often promotes the expectoration, sipping a cup of hot coffee proving very efficacious for this purpose in the morning expectoration of phthisical patients. I believe that I once saved the life of an infant by sitting up with it through the night,

and administering every few minutes a teaspoonful of hot milk and lime-water. Meanwhile the skin of the chest should be stimulated by rubbing it before and behind with hot camphorated oil, while in all cases showing increasing weakness of the heart, strychnin or nux vomica should be used along with 3 to 5 gr. of camphor, in sterilized almond oil, injected hypodermically in the loose skin of the abdomen. Between times the whole chest and abdomen should be wrapped loosely, either with flannel or with cotton batting. All oily expectorants should be avoided, and the bowels emptied, not by castor oil, but by doses of calomel, $\frac{1}{12}$ to $\frac{1}{8}$ gr. hourly, which, after six such doses, is to be assisted by a full enema of hot normal saline, at the temperature of 120° F., to make it a heart stimulant. The use of ammonia, in any form, as an expectorant is contra-indicated from its disagreeable taste to these little patients, when we have so much better expectorants in the agents already mentioned.

BRONCHIECTASIS

General dilatation of the bronchi is sometimes met as a congenital defect, but local dilatation is common whenever the tissue surrounding the bronchi is consolidated, so that it pulls upon the air-tubes and thus assists the mechanical dilatation caused by intrabronchial compression of the air in the act of coughing. We find it, therefore, postmortem at the apex, in areas which have been consolidated by tuberculosis. Such dilatation, however, is not easily diagnosed during life.

It is quite otherwise in portions of the lung, especially those about the base, which are more movable during the acts of breathing, when these regions are more or less fettered by extensive pleuritic adhesions. The walls of the bronchi, already weakened by prolonged coughing to get rid of the tenacious mucus, become dilated, usually in one of two ways, if not in both. One way dilates a bronchus into a fusiform tube of wide diameter, often wider than any of the main bronchi. In another form, whose situation is usually quite at the base of the lung, the dilatation is saccular, which may contain as much fluid as an old vomica. In the walls of this cavity both the muscular and elastic tissues disappear, and the inner lining of the cavity may be quite smooth. One striking peculiarity of this secretion we have already referred to, namely, that it becomes horribly fetid and may accumulate in large quantities through the night or day, until the patient bends down, whereupon the fluid becomes emptied into a main bronchus, and then is expectorated, with all its dreadful fetor. As we have remarked before, it is curious that these patients may continue to secrete and to

expectorate these fetid accumulations without the general health being in the least affected. The diagnosis of these large bronchiectatic cavities is usually easy, but, so far, their treatment is very unsatisfactory; the only remedy which holds out any prospect of a curative disinfection being a frequent and prolonged inhalation of the terebene ozone vapor of Dr. Bertram Waters, of New York.

GANGRENE OF THE LUNG

This complaint occurs from so many different causes that it may hardly be called a specific disease. In many cases no certain cause can be determined. In my experience the most frequent antecedent is some form of diabetes. A patient in the Roosevelt Hospital was admitted for general weakness and profuse diabetes insipidus, as he passed 110 oz. of limpid urine in the day, much more than could possibly be accounted for by what he ate or drank. Suddenly the diabetes ceased, to be immediately succeeded by extensive gangrene of one lung, from which he succumbed in thirty-six hours. The only case of recovery from pulmonary gangrene that I have met was in a case of diabetes mellitus, to be mentioned presently. Gangrene sometimes occurs as a sequel in intense lobar pneumonia at the base, but these patients are usually in a weakened state of health when the pneumonia is contracted. It may occur also in the areas supplied by a branch of the pulmonary artery, which has been occluded by an embolus. In the majority of cases, however, no particular cause can be given for gangrenous processes.

The **symptoms** of pulmonary gangrene are usually unmistakable, consisting of abundant expectoration of a very fetid character, and in the expectorated materials many fragments of lung tissue with elastic fibers are to be found.

Treatment.—The only treatment for pulmonary as well as for other forms of gangrene is by powdered opium, which should be administered in large enough doses to produce the physiologic symptoms of the drug, namely, contraction of the pupils and decreased frequency of the respiration. In one of my hospital patients who had very extensive gangrene of the back and the buttocks, following malignant purpura, 76 gr. of opium a day were administered before his pupils became affected, but when they did, the gangrenous process everywhere stopped. In one case which I saw, where all the symptoms of pulmonary gangrene occurred in a diabetic, the patient recovered under similar doses of opium, to succumb more than a year later to his original diabetic disease.

PLEURITIS (PLEURISY)

Pleurisy may begin with shivering, but not with the distinct rigor, as in the case of pneumonia. The two great serous membranes, the peritoneum and the pleura, fully illustrate the applications of the principles of our first chapter, that of the mechanism of "catching cold." Nothing is a more common antecedent of an attack of pleurisy than a local chill of the skin. As we explained in that chapter, one of the laws of vasomotor association is that the vasomotor nerves of the skin are always in relation with the same class of nerves supplying the tissues or organs underneath that cutaneous area. The first effect of cold is to contract the arteries of a part, and thus deprive that particular region of its normal supply of arterial blood; but just this effect is brought about by reflex action in the circulation of parts underneath, causing first arterial anemia, and hence damage to the tissue cells, to be followed by inflammatory reaction. This is illustrated frequently in the clinical accompaniments of pleurisy, which begin as a local inflammation of the pleura. It may also be remembered that we stated that this initial lesion prepares the way for microbic invasions of various kinds of the affected tissues. It is rather difficult to account for the invasion of the pleura by tubercle bacilli more commonly than by any other micro-organism. So frequently is this the case that probably over 90 per cent. of the attacks of pleurisy are tuberculous. This may not be easy to demonstrate at first in all cases, but in pleurisies accompanied by effusion the injection of the effusion into susceptible animals, like guinea-pigs, will then demonstrate the presence of tuberculosis without mistake. In men, after an attack of pleurisy with effusion, some may recover completely, but the rule is that in after years, sometimes five or ten years, these patients will develop phthisis. Even in some who apparently recover perfectly, the postmortem statistics of autopsies, both in Europe and in America, show such a number of chronic pleuritic adhesions, presumably of tuberculous origin, that we must admit that the pleuræ have a special tendency to develop tuberculosis far more than the peritoneum. This may be due to the fact that the tissues of the pleura are unrelaxing, so that its two surfaces rub against one another from 18 to 24 times a minute. The presence of pneumococci, however, in the effusion is not of unfavorable import. Quite otherwise is it with a pleuritic effusion showing quantities of streptococci, because this organism causes a much more serious and prolonged inflammation. The bacterial examinations, therefore, of pleuritic effusion ought to be made whenever practicable. Other micro-organisms are also to be

found in pleuritic effusions, though much less frequently than those we have mentioned.

Symptoms.—Clinically, the first sign of pleurisy is cough. As we have described in our chapter on Cough, where the pleuritis is limited and fibrinous, the cough is short and hacking, constituting the ominous hacking cough of the first stages of phthisis. As the inflammatory area extends, the exudation becomes more liquid or serofibrinous, the cough in the first stages being more severe if the exudation becomes more liquid, and serous as well as more abundant. The composition of this effusion closely resembles that of the liquor sanguinis, and if it becomes abundant, the cough at first subsides, because the two irritated surfaces of the pleura are separated from each other by the effusion. When, however, the effusion is absorbed the two inflamed surfaces come together again, whereupon, as we have before explained, the cough may become more violent, and is best treated by strapping the side. Another early symptom of extensive pleurisy is pain, which is of a stabbing character, indicated by the gesture of the patient with the tips of the fingers as before described. This pain is commonly accompanied, as we should expect, by an external tenderness and pressure.

A false dyspnea develops, which is not due to embarrassment either in the bronchi or in the air-vesicles, but wholly to the pain which the movements of the ribs and pleura produce, the breathing being very short and hurried. This pain should be easily distinguished from the pain in pleurodynia, due to inflammation of the intercostal nerves. I have often known this pain of pleurodynia to be mistaken for that of pleurisy, and so treated; but pleurodynia is not accompanied with cough, while pleurisy always is. Another symptom of pleurisy is fever. This ordinarily does not reach the degree of pneumonia, as its range is between 101° and 103° F. Pleurisy being a local disease, when at all extensive, the temperature on the affected side is higher than on the other side.

In pleuritic effusions there is nothing so misleading as variations in the vocal resonance. Usually, at first, the vocal resonance is diminished, but instead we may have it greatly intensified, even more than in pneumonia, so as to constitute true bronchophony. Sometimes in this condition it has a curious squeaking character, termed by Laennec, "egophony," from its supposed resemblance to the bleating of a goat, usually most evident at the angle of the scapula.

The seat of the pain is usually lateral or even under the scapula, where the ribs move most freely. At an early stage palpation may

give a sensation of rubbing, under the tip of the finger, but it is by auscultation that the most decisive signs are revealed, and directly under the inflamed area a to-and-fro rubbing friction sound is perceptible. This sound may first be heard only at the end of a full inspiration, but it quickly becomes double and is very superficial, thus distinguishing it from the fine crackle in cases of bronchitis. It differs from bronchitis, however, in that it is not modified by coughing, and also differs from the fine crackle of pneumonia in that it occurs on both inspiration and expiration, while the râle of pneumonia occurs only on inspiration, and is followed by clear expiration. While extensive pleurisy may be accompanied with some secretion of the viscid mucus in the bronchi, it may be said that bronchitis, as such, is not a common accompaniment of pleurisy, the expectoration not being bloody, but rather viscid in character.

Effusion in pleurisy varies greatly in amount in different cases, but if at all abundant it produces very characteristic effects, which, it should be remembered, are always of a mechanical nature. When it is limited to the lower regions of the chest, it produces more or less collapse at the base of the lung, with weakening of the respiratory murmurs, which sound distant and muffled. Both tactile and vocal fremitus may be diminished or even abolished. As we have said, the effusion may become so abundant that it fills the whole cavity of the chest on that side, extending all the way up to the clavicle. If this effusion has occurred slowly, the patient may be quite unaware of its amount, the only symptom being increased shortness of breath on exertion. In pleurisy the respiratory zone of the face should be observed so long as the effusion is limited, the nostril on the affected side being actively dilated. When, however, the effusion wholly fills that side, so that no air enters that lung, the nostril on the affected side collapses; while on the sound side it is actively dilated, in which case the air is driven out of the lung entirely, and the lung is pressed against the spinal column, and if it continues there for some time the lung is said to be carnified. The whole chest on that side bulges in comparison with the opposite side, and the intercostal spaces are obliterated and the respiratory movements abolished. Previous to this extreme degree of effusion, when it is level it does not reach the fifth interspace, the heart becomes displaced, with a change in the situation of the apex-beat. But the whole organ is pushed over, in left-sided pleurisy, to the right, so that the heart-sounds are clearer directly under the manubrium or along its right side, the right ventricle being directly behind the sternum. In right-sided pleurisy, with effusion, the heart may

be dislocated to the left, and the heart-sounds be clearest in the axilla.

With the accumulation of fluid, the percussion resonance gradually diminishes until it may end in absolute flatness. We can thus estimate progressive increase of the effusion from day to day. When the effusion rises above the fourth rib in front, a tympanitic note, called Skoda's resonance, develops directly under the clavicle. The percussion resonance has a resisting, wooden quality, different from the dulness of pneumonia. When the patient is in the erect posture the upper line of dulness is not horizontal, but higher behind than it is in front. With medium-sized effusions this line begins lowest behind, and then it advances upward and forward in a letter "s" curve to the axillary region, whence it proceeds in a straight line to the sternum. There is also a small area of from 2 to 5 cm. of dulness along the spine on the side opposite the pleurisy with the apex upward, caused by bulging of the mediastinum by the fluid. On the right side the dulness passes without change into that of the liver.

Palpation.—One of the most valuable signs of the effusion, when it does not reach above the fourth rib, is by carefully noting alterations in the vocal fremitus. This, as previously mentioned, is abolished by the effusion, but if the patient is sitting and the examiner places the tip of one of his fingers at the level of the fluid in front, and similarly, a finger of the other hand at the same level behind, when the patient leans forward, the vocal fremitus disappears from where it was in front, and reappears from where it was absent behind; and then, on having the patient lie down, it reappears in front and disappears behind.

Bacelli claims that the whispered voice is transmitted through a serous, but not through a purulent, effusion.

The lung, however, with its pleural covering does not hang in the chest like a body suspended in a bottle, but, owing to the presence of the heart and the great blood-vessels, an accumulation of fluid in the pleura follows a peculiar arrangement, which it is important to know when paracentesis is to be resorted to.

The duration of pleurisy is very unlike that of pneumonia, in that it does not terminate in crisis, but may last for days and weeks, as will be noted further on.

Treatment.—So long as the pleurisy is localized, as it so often is, with beginning tuberculosis, it may be safely left alone. Should the subjective symptoms, such as pain and the auscultatory symptoms, persist for some time, local blisters are of great value, but they should

never be applied in the acute stage any more than in other acute conditions. On the other hand, the rubbing into the part of blue ointment of mercury is of unmistakable advantage. When the sign of accumulation of fluid effusion has developed, no time should be lost to discover its nature by puncture with a hypodermic needle, when if the effusion proves to be purulent, no time should be lost to evacuate it. Certain facts, however, should now be borne in mind if the effusion proves to be serofibrinous. The tendency of all such effusions is to press out the air from the lungs. If this, as is commonly the case, should be at the base, the portion of the lung becomes more or less solidified by compression, and then begins that frequent final result of pleuritic effusion, namely, the affected parts of the lung become fettered by fibrinous bands. In extensive effusions these fibrinous bands or adhesions may in time make it impossible for the collapsed lung tissue to expand again, and when the effusion fills the whole side of the chest, the lung, as heretofore described, becomes changed into an airless viscus lying against the spinal column. It is this fettering of pulmonary tissue which so urgently calls for early removal of the effusion by aspiration, so that the lung may be expanded again before it is tied down by adhesions. The favorable results of early aspiration or early removal of the liquid prove that this measure is often too long delayed, because when performed early its risks are very slight. This is not at all the case when the effusion has been allowed to accumulate and remain for a number of weeks. When it reaches above the fourth rib to the clavicle, a number of serious dangers may occur during the operation of removing the fluid. It should be remembered that the thorax on both sides constitutes a pair of air-tight boxes, and if one of them full of fluid is too rapidly withdrawn, there must, on mechanical principles, be a powerful suction on both the pleural walls and on the fettered lungs. Hemorrhage, therefore, or true tearing of the lung substance may follow, but along with this the other lung has an intense strain thrown upon it, which leads to rapid bronchial effusion, which is often bloody as well as accompanied by general edema of its substance. Sudden death, therefore, may follow too rapid withdrawal of chronic effusions, as I have known in several instances. Therefore, I always enjoin that no more than 10 oz. at a time should be withdrawn. In many cases this so relieves the internal tension that rapid absorption follows, while all the fatal accidents just mentioned are prevented.

"The operation is extremely simple and is practically without risk. The spot selected for puncture should be either in the sixth intercostal space in the midaxilla or at the outer angle of the scapula in the eighth

space. The arm of the patient should be brought forward, with the hand on the opposite shoulder, so as to widen the spaces. The needle should be thrust in close to the upper margin of the rib, so as to avoid the intercostal artery, the wounding of which, however, is an exceedingly rare accident. The fluid should be withdrawn slowly. . . . In chronic cases of serous pleurisy, after the failure of repeated tappings, S. West has shown the great value of free incision and drainage. He has reported cases of recovery after effusions of fifteen and eighteen months' standing. Repeated tappings may be required in some cases. In the chronic cases the injection of adrenalin solution (20 to 30 drops of a 1 : 1000 solution) into the pleural cavity, after aspiration, has proved of value."

Surgeons are learning now that often all that is necessary in internal accumulations of fluid is to relieve tension by moderate withdrawal of the effusion, leaving nature to do the rest.

Very often, particularly in tuberculous cases, a great deal will be effected by firmly strapping the side with long straps of adhesive plaster, extending from the spine to the median line in front. These should always be applied from below upward, the patient taking a full inspiration as soon as the straps are applied to the spine, and then letting the air out by expiration while the strap is brought forward. The next strap ought to be applied over one-half the width of the preceding strap, care being taken to brace the lower side of the strap as one proceeds upward, so that the whole application shall be smooth and not wrinkled. I use this procedure very commonly in advanced phthisis over large cavities, as it greatly reduces both cough and expectoration.

There is one and not an infrequent form of pleurisy which is benefited by medicines, and that is when it occurs in rheumatic patients. Here the free administration of the salicylates is of unquestionable benefit.

PNEUMOTHORAX AND HYDROPNEUMOTHORAX

Pneumothorax, or an accumulation of air in the pleural cavity, sometimes occurs without any liquid effusion, which a description of a case in my own experience will fully illustrate:

A lady began to show unmistakable signs of a tubercular deposit at the apex of the right lung, when she suddenly was attacked with great dyspnea. Examination showed a total absence of any breath-sounds in the right chest, but with a hyperresonant percussion over the whole lung. The explanation of this condition was that a small

hole had been formed by softening of the tubercular deposit, which allowed the air to enter the pleural cavity until the lung was entirely collapsed, and pressed against the spinal column. Why such an accident does not often occur is due to pleuritic adhesions forming over every tubercular focus, but in her case such protective adhesions were absent, and thus allowed the entrance of air into that side of the chest, causing pure pneumothorax.

The great dyspnea characteristic of the first stage of pneumothorax is due to the other lung being too suddenly called upon to perform the whole duty of both lungs. Nothing can be done in these cases except to enjoin absolute quiet, then in the course of a few days the air will be all reabsorbed without any pleurisy or adhesions, because, as we have before mentioned, air in the bronchi and air-vesicles is normally sterile.

A more common condition is termed "hydropneumothorax," which occurs in the course of pulmonary phthisis, after the formation of a more or less large cavity. In such cases, if a communication between the vomica and pleura occurs, there will be both an accumulation of fluid and of air in the pleural cavity, causing what is called hydro-pneumothorax, a condition not infrequently present in the terminal stages of pulmonary phthisis.

The treatment for this condition is the same as that before prescribed for the original disease itself.

CIRRHOSIS OF THE LUNG

Connective tissue is always ready to take the place of parenchymatous tissue, whenever the latter becomes devitalized and degenerated. It has a variety of names applied to it, according to the tissue affected, but the condition itself is one and the same in them all. In nervous tissue it is called sclerosis; in glandular organs, such as the liver and kidneys, it is called cirrhosis; and in lung tissue it is mistakenly called interstitial pneumonia, whether vesicular or interstitial, the preferable term here being "fibrosis of the lung."

This process in the lung may be either local or general, so that a whole lung may be shrunken into a fibrinous mass, lying closely packed against the spinal column. The manner in which a lung becomes cirrhotic differs according to what texture of the lung is first affected. The process may begin with a pleurisy, which presents many bands or trabeculae penetrating the lung in all directions, soon obliterating all traces of air-vesicles, but not the bronchi, which, instead, may be dilated. Another form of pulmonary fibrosis begins in the peribronchial

tissue of the finer air-tubes, and from there invades interlobular spaces, with hyperplasia of their connective tissue. This process very frequently starts from a tuberculous focus, especially at the apex. Where the process is limited to one lung, the shrinkage of the tissue causes great contraction of that side, with displacement of the heart, pushed over as it is by the emphysematous compensatory enlargement of the opposite lung. In many cases the opposite lung is also tuberculous, so that numerous bacilli may be found in the expectoration. On the other hand, the lung originally affected, although it began with tuberculosis, its fibrosis obliterates any trace of the original infection, so that many patients with fibrotic phthisis will show for months no tubercle bacilli in the sputum.

Lung fibrosis, as we have already intimated, may be partial or general; partial when it is connected originally with some localized affection, such as bronchopneumonia. When general, it tends to become unilateral, and to remain so for many years, with great shrinkage of the side and corresponding displacement of the heart. Not only are the interstitial spaces obliterated, but the ribs may even overlap, the shoulder being greatly depressed, and the vertebræ displaced toward the affected side. With all this the patient may enjoy a fair degree of health for a number of years, but always with more or less cough and bronchial secretion. Not uncommonly hemoptysis sets in suddenly and may be the cause of the patient's death, but if the patient walks on a level and does not tax his breathing by muscular or mental effort he may continue for a number of years in a fair state of health.

The **treatment** of such cases is necessarily limited to the observation of hygienic rules.

EMPHYSEMA

All the acts of coughing have a tendency to dilate the air-vesicles by a mechanism easily understood. Similarly, compensatory overdistention occurs in the air-vesicles of a region contiguous to any part of the apparatus of breathing which for the time has its respiratory function in abeyance. Thus, if the base of a lung is compressed by a pleuritic effusion, the air-vesicles at the apex become overdistended by more active breathing. Likewise, if one lung is prevented from breathing from any cause, the opposite lung is in the state of compensatory emphysema. The commonest cause, however, of permanent emphysema is general chronic bronchitis affecting both lungs, for it should be remembered that in the act of coughing the free exit of air is forcibly interrupted during expiration, and the longer the

bronchitis lasts, the more certain it is that the air-vesicles will become not only permanently dilated, but may be ruptured in many localities, so as to constitute simple cavities. The effects of this condition are easily explicable on mechanical grounds. Large tracts of air space in the lungs are thus no longer free in the aëration of the blood. The whole chest becomes altered in shape, so as to contrast, in every way, with the shrunken lung tissue of phthisis. The movements of the ribs also are altered, so that in place of the anteroposterior and lateral movements of expansion, the chest moves mainly up and down, with very little expansion in other directions. The work of the accessory muscles of respiration, which are attached to the clavicles and to the scapula, is so increased that these muscles become greatly hypertrophied, while the chest itself becomes barrel shaped.

The changes in the pulmonary tissues themselves consist in very extensive rupture of the septa between the air-vesicles until they may form cavities of varying sizes with great destruction of the capillaries on the walls of the vesicles, through which aëration of the blood occurs. This necessarily entails increased labor on the part of the right chambers of the heart from dilatation of both the right auricle and the right ventricle, leading to enlargement of the veins of the neck from incompetence of the tricuspid valves, and in extreme cases of prolonged chronic bronchitis with emphysema, general venous stasis with anasarca may result.

One peculiarity of emphysema is that in many cases it is undoubtedly due to congenital weakness in the walls of the air-vesicles, owing to the absence or sufficient development of the elastic fibers. One evidence of this is its frequent occurrence in families, so that it is, unquestionably, a hereditary affection. These cases as well as other instances of emphysema are often cyanotic to a degree not seen in any other disease, except in some instances of congenital heart malformation. The cyanotic emphysema patients, however, may be able to go about their business with very little inconvenience, except from active muscular exercise. As may be naturally inferred from its common origin in chronic bronchitis, emphysematous patients are apt to catch cold from slight exposure, because, in addition to the bronchitis, they are subject to asthmatic paroxysms.

The **physical signs** are plain enough on most superficial examination. If an inspection shows dilated veins in the temples, and all the way down in the course of the jugulars on the right side during coughing, the supraclavicular bulb frequently dilates into a tumor. We have already mentioned the characteristic barrel shape of the chest

and the great hypertrophy of the muscles attached to the clavicles and the scapulæ. The shoulders are high and rounded, and the mouth is never closed, the nostrils remaining in a permanently fixed state of dilatation. Percussion is resonant everywhere, so that the normally dull areas over the heart are no longer present, the emphysematous lung completely overlapping the heart, as it is more likely to be dilated at the anterior borders of the lung than elsewhere. The heart impulse is felt only in the epigastrium. On auscultation, no vesicular murmur is present, but instead every variety of cooing or harsh bronchial breathing sounds are heard, produced by secretions in the congested bronchial tubes.

The treatment of the disorders of emphysema should always be causative; in other words, it should be that of chronic bronchitis. The iodids are equally indicated here as in that affection, and some good may be expected from arsenic combined with remedies for conditions of an asthmatic kind, as previously described. All measures calculated to diminish bronchitis should be persevered in at all times. In the congenital cases, if there is evidence of premature hypertrophy and calcification of the upper costal cartilages, Freund's operation for the resection might be tried.

EMPHYEMA

This means lung abscess, and is occasioned by different causes. It is much more common in children than in adults, particularly after an attack of pneumonia. As the abscess forms in an organ of constant movement, and always under high tension, the pus, as it is secreted, may go anywhere: it may burst into a bronchial tube, and thus form a bronchial fistula, or it may appear either on the chest wall before or behind, or it may take a downward course and come out in the groin, or it may perforate the diaphragm, and give rise to subphrenic abscess. Usually the course of a fistula which leads to its original source can be easily made out, but sometimes, when the abscess is at first deeply seated in the lung, it is difficult to locate it, and we have to rely upon the constitutional symptoms of septic infection to guide us, the patients continuing to show the symptoms of serious infection, which are high fever, with characteristic daily rise and fall of the temperature, accompanied by great wasting and loss of strength. Empyema, therefore, can never be regarded as a trivial complaint, but the aim should always be to trace it to its source, for the purpose of thorough drainage. In children and not infrequently in adults this may be done only by a partial resection of one or more ribs. I once cured a patient by a

single aspiration of the pus. This procedure, however, should not be recommended.

Empyema also occurs as a sequel to many specific fevers, especially scarlatina. It is, therefore, preëminently a surgical affection and, as such, need not be further considered here.

HICCUP

This is a spasmodic affection of the phrenic nerve which may be very trivial and temporary, but at other times, as we have already mentioned, in the course of chronic interstitial nephritis, a serious symptom, not at all amenable to ordinary remedies. It is particularly ominous when it occurs in conjunction with abdominal lesions, such as strangulated hernia or peritonitis.

The best treatment for this troublesome affection is by teaspoonful doses of the spirits of chloroform in water, every two or three hours, conjoined with hypodermics of $\frac{1}{80}$ gr. of pilocarpin, which may be increased to $\frac{1}{16}$ gr.

CHAPTER VI

DISORDERS OF THE ORGANS OF DIGESTION

IN our species the condition of digestion of food differs materially from those of other animals. The old prophet says that an ass knoweth his master's crib, to which statement we may add that the reason why that animal is content with his nutritious but unvarying diet is simply because he is an ass, while it would take a widely read geographer to correctly state whence comes every article found on an ordinary mechanic's table; still more at a banquet, as the air above, the earth below, and the waters under the earth of every clime are made to contribute something to the feast. The commerce of the world, in fact, is largely occupied with providing for men's appetites. Besides all this, it is man alone who cooks his food.

We mention these facts because many of the digestive troubles for which physicians are consulted are not due to the patients being animals, but rather because they are human beings and live as such.

STOMATITIS

The mucous membrane of the mouth is very subject to inflammations, usually limited to the inner surfaces of the lips and the cheeks. Writers describe a number of different forms, but they all have, in common, conditions of constitutional debility, induced slowly by improper food or defective hygienic conditions, chiefly in children or infants. That these affections of the mouth are not of local origin is strikingly illustrated by the prompt improvement of any one of the forms by change of air or of surroundings, or in infants, change of the milk supply.

Thrush.—One kind of stomatitis, however, has a specific origin in the form of an yeast fungus, called *Oidium albicans*, or *Saccharomyces albicans*. Its ordinary English term is "thrush," and the French, "muguet." But it illustrates the dependence of mouth inflammations upon constitutional conditions, that the worst forms of thrush occur in adults in advanced stages of phthisis, as well as in diabetes mellitus; while most frequently developing in children, these facts show that it is by no means confined to them, because it should be here noted

that for various reasons the period of childhood is the most vulnerable period of life. One evidence of this is that, bulk for bulk, the blood of a child is much below that of an adult in its proportion of red corpuscles. The most certain remedy for deficiency of red corpuscles that we possess is cod-liver oil, as before mentioned, and cod-liver oil is the medicine of medicines for debilitated children.

Treatment.—Besides attending to the general health, stomatitis, whether ulcerative, aphthous, or of fungous origin, should be treated constantly with mouth-washes. These may consist of chlorate of potash, 10 gr. to the ounce, or of sulphite of soda, a dram to the ounce of peppermint-water, or if the breath is foul, with 1 gr. of permanganate of potash in 6 oz. of cinnamon-water.

Aphthous Stomatitis.—One kind of stomatitis is called aphthous. This is also known as follicular and vesicular stomatitis, characterized by the presence of small slightly raised spots surrounded by reddened areolæ, appearing first as vesicles which rupture, leaving small ulcers with bright red margins. They are seen most frequently on the inner surfaces of the lips, the edges of the cheeks and tongue, but not in the pharynx. This form is met with most often in children under three years. The vesicles come out with great rapidity, and the little ulcers may be fully formed within twenty-four hours.

Treatment.—Each ulcer should be touched with nitrate of silver, and the mouth should be thoroughly cleansed after taking food, a wash of chlorate of potash, 10 gr. to the ounce, or local application of the glycerite of borax being efficacious.

Ulcerative stomatitis is often called fetid stomatitis or putrid sore mouth. The morbid process begins at the margin of the gums, which become swollen and red, bleeding readily. Ulcers form, covered with a firmly adherent membrane. They extend along the gum line in both jaws. Salivation may also occur and the breath is foul. Chlorate of potash is very successful, both taken internally in doses of 10 gr. three times a day for a child, while it may be applied directly to the ulcerated surface as a powder. Sulphite of soda, a dram to the ounce of peppermint-water, may also be used as a mouth-wash.

Parasitic stomatitis belongs to the order of the yeast fungi, and consists of branching filaments from the end of which torula cells develop. The disease never occurs upon a normal mucosa. It begins on the tongue in the form of slightly raised white spots, which increase in size and gradually coalesce. The membrane thus formed can be readily scraped off, leaving an intact mucosa, but the membrane may extend over the cheeks and lips and hard palate, involving the tonsils

and the pharynx, and may even extend beyond this into the esophagus. The mouth is usually dry, in contrast to the salivation accompanying aphthæ, and in the treatment of a child's mouth it should be kept scrupulously clean. Lime-water, or a dram of bicarbonate of soda to a tumblerful of water, but particularly peppermint-water, are useful.

Gangrenous stomatitis, also called **noma**, is a rare affection, occurring almost exclusively as a sequel in measles. Like some gangrenous inflammations elsewhere, its onset may be overlooked from the absence of pain. In some cases the ulcer is very small, but perforates the cheek, and it may extend, in debilitated children, to the eyelids above and to the jaws below. This affection is usually fatal within a week. The only local application is the permanganate of potash, 1 gr. in 6 oz. of cinnamon-water.

Mercurial stomatitis, or **ptyalism**, is rarely seen now compared with former times, when mercury was so generally used for all inflammations and in specific fevers. Its first symptoms are ordinarily connected with the teeth, which to the patient seem somehow to have become too long. A metallic taste is soon present and with it a very free flow of saliva. In bad cases the parotid glands swell and are tender to pressure. At present we rarely see salivation occur except in those who have an idiosyncrasy against mercury, but such cases occur and are unexpectedly salivated by very small doses of a mercurial. Salivation soon gets well spontaneously, and should be treated in all cases with mild mouth-washes, such as 5 gr. of borax to the ounce of peppermint-water.

Leukoplakia.—True leukoplakia consists in the development on the dorsum of the tongue of a white patch, which is wholly independent of syphilis or of any of the membranous forms of exudation on the tongue or cheeks. I have seen it in cases where a syphilitic infection was out of the question. It is said to be in some patients a sign of the approach of cancer of the tongue, and hence should not be treated with any irritant applications. It is, however, a very obstinate affection, though in its true form it causes no discomfort whatever, and would, therefore, be better left alone.

ORAL SEPSIS

Dr. W. H. Hunter has directed attention to the great importance of oral sepsis as a cause of serious disease, both of the stomach and of the intestines. He even claimed that infection of the gastric mucosa, by the constant swallowing of infected secretions from decayed teeth, was one of the causes of pernicious anemia. That

led me to examine the mouth of every case of pernicious anemia which came under my observation, and I found one instance, in a policeman, who undoubtedly was constantly swallowing quantities of infected pus, with a result that he presented the identical picture of pernicious anemia, including nucleated red corpuscles and myelocytes in his blood, with a high color-index. When his mouth was attended to he apparently recovered, and remained well for more than a year, after which I lost track of him. But other cases of pernicious anemia showed no evidence of oral sepsis as a cause of the disease. Latterly, Dr. Hunter has returned to the subject, and demonstrates that a great many cases of infected dentine roots are masked or covered up by the procedures of dentists, so that the most serious constitutional infection may occur by the operation of dentists covering over morbid conditions of the teeth. I myself have no doubt that his contention is largely correct, for I have repeatedly relieved some obstinate catarrhal conditions both of the stomach and of the intestines by thorough use of an antiseptic wash for the teeth, after having other diseased roots of the teeth extracted. These patients should use carbolic acid lotions night and morning, beginning with 1 part of carbolic acid to 40 of peppermint-water, and gradually increasing to 3 or 4 parts of acid. It is not uncommon to find that the tongue also becomes involved by a form of glossitis affecting its under surface, and which seems to have a specific connection with this source of infection.

BAD BREATH

Some writers speak of bad breath as being due to local conditions in the mouth itself, such as carious teeth, and accumulations in the follicles of the tonsils, but these causes of bad breath are insignificant compared with fecal accumulation in the lower bowel. We should remember that the mucous membrane of the descending colon presents an actively absorbing surface, illustrated in our frequent recourse to nutritive enemata. When fecal matter, therefore, has descended into the lower bowel in a semifluid state, its watery constituents are rapidly absorbed until, in habitual constipation, the contents become quite hard. It is during this absorption that the blood becomes charged with volatile fecal odors, which are then carried to the lungs, to be exhaled there, and thus affect the breath.

Treatment.—The best treatment which I have found for this common, but always disagreeable, condition is to deal properly with the condition of the lower bowel. For this purpose a prescription of 4 drams of sodium benzoate, $3\frac{1}{2}$ drams of sodium salicylate, 20 gr.

of thymol, and 10 gr. of powdered rhubarb, divided into 48 capsules, will soon correct the trouble, the dose being 2 capsules an hour after each meal and at bedtime.

For the condition in the mouth itself before alluded to, a wash frequently used of $\frac{1}{2}$ pint of cinnamon-water with 20 gr. of the chlorate of potash will usually suffice.

AFFECTIONS OF THE ESOPHAGUS

Stricture of the esophagus may be permanent and last for years, and nevertheless be altogether due to nervous spasm. I once had a boy ten years old brought to me from Wappinger Falls, N. Y., who up to this time had always vomited his food soon after taking it, but had no gastric symptoms whatever. Something seemed to collect in his esophagus, causing, when he was asleep, a noise in the throat from mucus collected in the gullet, until from its quantity it awoke him either to cough or to vomit. Upon taking solids, they were thrown up the next day unchanged. When brought to me, he was very emaciated from starvation. I then sent him to a well-known surgeon of the Roosevelt Hospital, who was sure that he had an organic stricture of the esophagus, which resisted all attempts to dilate it by bougies. I was sure, however, that the stricture was simply spasmodic, and therefore, on my advice, the surgeon established a gastric fistula through which he could be fed by the stomach. The boy then rapidly gained weight, and after allowing the esophagus to remain quiescent for three months, the largest sized bougie passed readily through the site of the former stricture, and the patient was afterward fed exclusively by the mouth.

Spasmodic stricture of the esophagus is also not uncommon in hysteria, and may prove equally intractable until the patient recovers from appropriate treatment.

Every case of apparent stricture of the esophagus should be carefully examined to determine whether the obstruction in swallowing may not be due to pressure on the esophagus from growths or other similar causes entirely outside the gullet. I was once called in consultation by Dr. Monae Lesser, of this city, to a case of supposed stricture of the esophagus by cancer, a not unnatural surmise, as the patient was sixty-seven years old and had a cachectic appearance. I then examined the spine of the patient, and opposite the third and fourth dorsal vertebræ found a suspicious area of dulness on percussion. I then asked the patient whether he could not swallow liquids if he lay down, and he said he could if he lay on his left side. This answer ex-

cluded cancer, but I soon found that he had enlarged glands in his neck and also a number of tumors in the abdomen apparently connected with the liver. In short, he was a case of Hodgkin's disease, some tumors of which pressed against the esophagus, but fell away from it when he lay on his left side. Similarly, the physician should not forget that the esophagus may be pressed upon by an aneurysm.

Otherwise the esophagus, when constricted at its lower end near the stomach, may become very much dilated and its walls hypertrophied. Food and drink will accumulate in quantity until they are brought up by the efforts of the patient. Sometimes, however, it consists mainly of mucus, not uncommonly called by nervous dyspeptics water-brash.

Organic affections of the esophagus not due to cancer are nearly always due to the swallowing of caustic poisons, such as arsenic, corrosive sublimate, or carbolic acid. These not only cause very painful dysphagia at the time, but lead to chronic ulcerations with cicatricial tissue, narrowing the lumen of the tube, and which then only can be treated surgically. The esophagus also occasionally has diverticula, which may be elongated into narrow passages leading, in some recorded instances, to openings on the skin, but such abnormalities are hardly more than curiosities. In the course of the specific fevers, ulcers may form in the esophagus, during small-pox, or diphtheritic membranes extend from the pharynx down.

DISORDERS OF THE STOMACH

INTRODUCTION

Habits in digestion are both physiologic and personal. The physiologic habits are illustrated by the definite and orderly sequence of secretions, according to the tract of the alimentary canal traversed by the food. Thus, the saliva is first secreted in the mouth by the stimulation of the presence of food and by the movements of mastication. The chief use of saliva is to convert the starches into sugars, which it has time to do when it accumulates for an hour in the fundus of the stomach. Meantime the proteins of the food are first digested by the gastric juice secreted between the fundus and the pylorus, the resulting acid chyme being discharged at intervals through the relaxed pyloric sphincter into the duodenum. Here a remarkable process follows, the nature of which has only lately been demonstrated. Instead of the presence of the acid chyme in the duodenum stimulating the important

pancreatic secretions to flow by nervous reflex, as was once thought, a substance, called secretin by Starling, is first formed in the jejunum, which on being absorbed into the blood acts powerfully on the pancreas. But this secretion, after it is formed, can be isolated from the jejunum, and then if injected anywhere into the blood it stimulates the flow of the pancreas just the same as if it were absorbed directly from the jejunum. The small intestine is a long digestive secreting tract, and Starling's observations show that for each part its special secretion is formed.

The ranks of no disciplined army, therefore, could more regularly take their allotted places than do the glands of the alimentary canal with their well-timed secretions, but these successive performances take time. After a full meal three hours should be given properly to complete the work.

Personal habits of eating and of drinking may play havoc with physiologic discipline. Thus, a gentleman called one day whose countenance wore the sad expression of a confirmed dyspeptic. This led me to begin with an inquiry into his daily habits of eating, which should always be done with every case of dyspepsia. He said that he always took his breakfast, watch in hand, in order not to miss the train, which he and his friends had engaged to leave a suburban town at such a minute for an hour's ride to the city. Now if there be anything which the stomach resents it is such watching. On the train all smoked and talked about the day's money market in Wall Street. At his next meal he with the same friends stood at the counter of a restaurant, and while eating were absorbed in discussing the stock quotations. Toward evening he had his hour's ride out to take his dinner at home, tired with the day's business. That meal over, he felt sleepy and took a nap, to find afterward that he could sleep only in snatches and with many dreams. These digestive habits had been continued for nine years. I have had so many similar experiences with business men whose meals were timed by express trains that I can diagnose them at once as "rail-road dyspeptics." It is useless to treat such persons as cases of chronic gastritis, or to prescribe for them reputed remedies for gastritis. Change their habits, and the long-suffering stomach gets well spontaneously.

But there is another and specially human factor in digestion by the stomach, and that is mental interest. We are social beings, and in all ages men have disliked to eat alone. The table is the place for wit and conversation, and in proportion as both abound it is noteworthy how much most dyspeptics can eat. Commonly, both in man and in

animals, fear and anger wholly arrest digestion. Cannon found that all movements of the stomach ceased in cats the moment the animal showed signs of anger.

When inflammation or gastritis is actually present its symptoms become objective, and the stomach should be examined for them with the patient on his back and the legs drawn up. The commonest of these symptoms is tenderness to pressure in the epigastrium, with muscular resistance. Distress referred to the stomach, with nausea and vomiting, but with resistance to pressure absent, means something else than gastritis.

Normally, we should not know that we have either a stomach or intestines, and our attention is called to them only when they are disordered, hence the importance of accurately dating the first sign of such discomfort. In no class of affections is the whole history of the patient so important. Thus, I dislike to hear a patient who is past middle life state that he always had perfect digestion until a few months before, when without anything to account for it he began to be distressed after eating, because that often means the advent of gastric ulcer. If, on the other hand, he has had the same bad symptoms for years, cancer may be ruled out.

Besides the tenderness and resistance to pressure at the epigastrium, the patient usually has loss of appetite, and a sense of weight or distress or even pain after eating, with a furred tongue red at the tip and a bad taste in the mouth. Other symptoms often suggest the cause of the gastritis. Thus, old toppers lose all taste for a meat diet and prefer milk and Vichy. Morning nausea is common with them, while they hawk up quantities of tenacious pharyngeal mucus which they ascribe to catarrh.

It should be remembered that all normal digestive secretions have two distinct functions, the first digestive, and the second antiseptic or antifermentative, and the symptoms may be mainly due to deficiency in either of these functions. Thus it may be difficult to decide whether a case of flatulent dyspepsia is due to want of secretion or to change in its quality. As a rule, the latter is owing to causes extrinsic to the stomach itself, as in portal congestion from heart disease, toxemia from Bright's disease—a quite common cause—or adhesions of the pyloric region to contiguous parts as results of gastric ulcer. All cases of cirrhosis of the liver are also characterized by matting together of coils of the intestines, as well as similar fettering of the stomach walls. The adhesion of the walls of the alimentary canal to contiguous parts can never occur without accompanying symptoms.

In the stomach as in no other organ lined by mucous membrane is the saying so often illustrated that no mucous membrane has any business to secrete mucus. In many disorders of the stomach we find that its mucous membrane is covered with thick tenacious collections of mucus, and scarcely any greater advance in treatment has occurred than the practice of washing the stomach out, technically called "lavage." Layers of such mucus may be found in any part of the gastric cavity, but especially in the regions which secrete the gastric juice, with the result of greatly diminishing the normal acidity of the hydrochloric acid necessary for digestion. This mucus, besides being itself an unmistakable sign of inflammation, also affords a nidus for the growth and development of micro-organisms, which cause fermentation and the accumulation of irritating gases. Instead of hydrochloric acid, therefore, we have lactic acid, which, however, is rarely injurious, butyric acid, which is very irritating, and acetic acid. Patients themselves find out that they are troubled with what they call "a sour stomach." This form of acidity gives rise to painful sensations in the epigastrium and in the esophagus, a condition commonly called "heartburn." But the stomach, it should be remembered, also presents an active absorbing surface, and many poisons are absorbed from it directly into the blood, producing such symptoms as headache and depression of spirits, all of which are typically present in the affection called migraine or sick headache, in which the decomposition of gastric contents may cause actual vomiting, as will be further detailed in our article on Migraine. The treatment of such gastric disorders resolves itself into both prophylactic and directly remedial measures. To the prophylactic class we would rank first abstinence from all hurry in eating or drinking. As we have seen, all the steps in digestion are both successive and gradual, the act of mastication itself having been demonstrated by Pawlow as increasing, through reflex action, the flow of gastric juice.

But a further effect is obtained by the thorough admixture of the food during mastication with saliva, which, as we have seen, continues its digestive effects in the fundus of the stomach itself. Besides deliberation in eating, other factors enter, one of which is that in the case of proteins there must always be a nicely adjusted balance between the intake of food and the excretion of the final products of metabolism by the kidneys. Thus, the excretion of urea is more than double during eating than during fasting. If the kidneys are chronically diseased, this additional work caused by eating may so raise the blood-pressure as to bring on apoplexy. On that account more cases of

apoplexy occur just after a Christmas or Thanksgiving dinner than at other times.

This is a proper place to allude to the *use of alcoholic drinks*. The statement cannot be too clearly emphasized that if people would take alcoholic drinks only while they were eating there would be no drunkards. There is a natural antagonism between alcohol and food. During the act of eating the stomach will allow only a comparatively limited amount of alcohol to be taken. If this limit be exceeded, digestion stops, to be followed by vomiting of the food, unless the stomach is spared further alcoholic addition. But this fact is illustrated still more strikingly in cases of chronic alcoholism. One of the best signs that a man is taking too much alcohol for his good is that he no longer chooses to eat beefsteak or other meats, but prefers to take swallows of milk and Vichy. So in proportion as he indulges in alcoholic drinks he loses all desire for hearty food, until his abstinence becomes extreme. I have not known a case of delirium tremens, either in hospital or private practice, who had taken anything to eat for a week or more, and the first indication in the treatment of delirium tremens is not only to stop alcohol, but also to feed the patient, for it is only the taking of food which counteracts the craving for more liquor. But though many persons may not take enough liquor at one time to become intoxicated, yet, by very frequent tipping, they will in time present symptoms which are truly characteristic of their condition. The hands are large and soft, the throat is congested and covered with slimy tenacious mucus, which induces morning hawking, with sometimes vomiting. These people never take a hearty meal. Their sleep is also imperfect, and the action of the bowels is scanty and irregular. They become generally sluggish in their movements and fitful in all mental exertion. In other words, the man has lost his grip upon life. I have often told such patients that they were taking too much alcohol for their good, and have had them emphatically deny that they were toppers because they were never drunk. I have, therefore, tested them in this way, asking them to take an empty pint bottle and fill it with whisky and then find how long this whisky would last. They will commonly insist that it will last them several days, only to be afterward astonished to find it is all used up before one day is finished.

As is well known, one of the most common results of alcoholism is disease of the liver, either in the form of hypertrophic or atrophic cirrhosis. As all the blood of the stomach has subsequently to pass through the liver, it can readily be seen that chronic congestion of the mucous coats of the stomach must follow, with a tendency to actual

ulceration. This is especially the case when the alcohol has been taken on an empty stomach, and the downward course of such victims often begins with a morning cocktail. Continuous alcoholic craving is particularly liable to occur in those who take stimulants when the stomach is empty.

One rule to go by for prescribing or prohibiting the taking of alcohol depends upon examination of the urine. If this be neutral or alkaline and loaded with phosphates, the patients are nervous and sleepless with a tendency to loss of flesh. Their nervous condition, therefore, calls for a sedative. In our chapter upon Remedies we have spoken of an important class of nervines which are both stimulant and sedative at the same time, meaning that they are stimulant to certain nerve functions and simultaneously depressing to others.

This is pre-eminently the case with alcohol, for while it is a stimulant to certain mental functions and also to the action of the heart, it is at the same time powerfully sedative to all reflex impression. Thus, if a person in health should take a full dose of brandy, he will find that on testing with the proper instrument his tactile sensations—at the tip of a ring-finger and the tip of the tongue—their sensitiveness is markedly decreased. With a further increase of alcohol he no longer knows where his feet are, and, therefore, staggers in walking. This is not due to motor paralysis, as a drunkard soon shows on becoming excited, but is due to that depression of the sensory muscular nerves which is indispensable for muscular co-ordination. But in many cases of nervous debility reflex excitability of the sensory nerves is so increased that sleep or ordinary quiet is impossible, and in time the patients are worn out by the undue irritability of their surface nerves. With them the sedative action of alcohol is invaluable in promoting sleep and a return to health.

As before stated, they should never take alcohol except while eating, a fact to be borne in mind by the physician when he assumes the responsibility of recommending the patients to take this agent. On the other hand, if the urine is diminished in quantity, with high color and increased specific gravity, no matter from what causes, a physician should not think of prescribing alcoholic stimulants.

A physician is often asked about tobacco, and many solemn warnings against tobacco are uttered by those who do not use it. No agent, not even alcohol, is so universally used in all times and countries as tobacco since its introduction from America in the early part of the 17th century, and the failure to show that tobacco has in any way injured the human race or increased its proclivity to disease proves

how harmless tobacco is. On the other hand, like any other agent, excess in its use may do harm to certain functions, which are easily defined. Thus, excess in tobacco deranges the action of the heart, and it should be prohibited in all cases of marked cardiac debility. It, however, should, if possible, be used after meals, for the gastric juice has a great effect in modifying it, and likewise it is best not to smoke in the open air. Thus, a man should not smoke a cigar while driving a horse, for the rapid current of air causes a generation in the lighted cigar of a poisonous fusel oil which makes the hand very unsteady.

ACUTE GASTRITIS

This condition may have many exciting causes. One of them is the swallowing of corrosive poisons, often with suicidal intent. The symptoms, then, are those of burning pain referred to the epigastrium and violent vomiting. No time should be lost in administering the proper antidotes. The patient complains of burning thirst, and should be allowed to drink water very freely, which, in fact, may make the vomiting easier. Some cases of acute gastritis from swallowing corrosive poison have been reported whose after-effects have been an extraordinary wasting of the stomach, with contractions, so that it can contain but a fraction of its ordinary contents.

The commonest cause of acute gastritis in adults is due to the taking of large quantities of alcohol upon an empty stomach; fortunately, nature very commonly relieves them by active vomiting. It is otherwise when acute gastritis occurs at the onset of the specific fevers. The stomach trouble then is one of the complications of the complaint, which usually will soon subside with the progress of the disease.

Among the other and more common causes of acute gastritis is the ingestion of improper articles of food, especially unripe fruit. In such cases the mucous membrane is everywhere reddened. Vomiting, in fact, is a great preservative of the stomach from serious inflammation by the retention of irritant particles.

Treatment.—The first indication in the treatment for such cases is to give wineglassful doses of equal parts of milk and lime-water, at intervals of fifteen minutes, until the symptoms subside.

CHRONIC GASTRITIS

The occurrence of chronic gastritis from the various causes which we have enumerated in time produces organic changes in the mucous and submucous tissues of the stomach. This is especially illustrated

in the region of the pylorus. The first changes there are shown by an increase in the folds of the pyloric mucous membrane; afterward in a hypertrophy of the submucous layers, which may or may not be accompanied by ulceration, but which often ends in such thickening or contraction as seriously to interfere both with the movements of the stomach and with the proper emptying of food through the pyloric canal into the duodenum. This pyloric obstruction in time leads to dilatation of the stomach itself, with other disorders to be described later.

Treatment.—In the treatment of chronic gastritis the first object, as we might expect, is a painstaking inquiry into the habits of eating of the patient. Many cases of inveterate dyspepsia leading, it may be, to obstinate vomiting or pain after eating may be relieved by change of diet alone. For this purpose milk takes the most important place. Milk contains all the elements out of which the body may be built, as is shown by the growth of infants and young children, for every tissue of the body is built up out of materials furnished by milk. On that account we cannot imitate artificially such a universal food. On the other hand, in the case of cows' milk, adults particularly find this article rather indigestible. The reason for this is not far to seek, for the first step in digestion of milk is the precipitation of its casein, a process which uses up a large part of the pepsin of the stomach, so that not enough is left for the further digestion of the precipitated casein or curd into a liquid which can be absorbed. All races, therefore, who have to live entirely upon milk, such as the Bedouins, the Tartars, and the Gauchos, of South America, ferment the milk first; in fact, all people in Western Asia do the same, using for this purpose the yeast plant; while the Tartars use a lichen called kefir for the same purpose. This process of fermenting usually takes from ten to twelve hours. The fermented milk should then be smooth and not like ordinary sour milk, having a slightly acid flavor. The best way to use it is not to drink it in any quantity at a time, but to take it as one would take soup, because it is best borne when the stomach has had time, as in the taking of soup, to adjust itself to the intake of this food. In many cases it is better to break bread into the milk, and there is no objection to sweetening it with sugar by those who so prefer it. I have cured cases of obstinate dyspepsia, and many of them accompanied by vomiting, by the use of these fermented milks, which I was the first to introduce into this country, and which are now sold extensively under the name of koumiss or zoölak, which is fermented milk bottled, there being numerous preparations of the same kind on the market.

Medicinal Treatment.—Besides regulating the diet, as we have mentioned, some medicines have a decidedly curative effect. Of these the first is the bichromate of potash, recommended by Professor Fraser, of Edinburgh, which may be prescribed in pill form:

R. Kal. bichrom..... gr. iss;
 Bismuth. subcarb..... ʒ iss;
 Extract. gentian..... q. s. —M.

Ft. pil. xxx.

Sig.—One pill one-half hour before each meal.

and the following:

Resorcin..... ʒ ij;
 Tinct. nucis vomicæ..... ʒ iiij;
 Syrup. zingiberis..... ʒ iss;
 Aquæ menthæ..... ad. ʒ vi.—M.

Sig.—Two teaspoonfuls in water, one-half hour after meals and at bedtime.

A very serviceable remedy for chronic gastritis with ulcer is powdered condurango, which may be given in the following prescription:

R. Pulv. conduran. }
 Bismuth. subcarb. }..... ʒ iv.—M.

Ft. pulv. xvi.

Sig.—One powder an hour after each meal.

It is in chronic gastritis that gastric lavage is so beneficial. Usually 1 gallon of water introduced through a stomach-tube answers. The mucous membrane of the stomach in all cases of chronic gastritis is covered with a thick coating of mucus, which greatly interferes with the normal gastric secretions and should be washed until no mucus appears in the return flow. If there is much mucus, it may be advisable to wash with an alkaline solution, of which as good as any is 2 drams of sodium bicarbonate to the quart of water. The best time for lavage is in the morning before breakfast.

PHLEGMONOUS GASTRITIS

This is mentioned in medical literature, but is of very rare occurrence. Theoretically, it might follow the impaction in a gastric artery by an embolus. It may be due to direct infection of a lesion in the stomach by pyogenic micro-organisms like the *Streptococcus pyogenes* or the *Staphylococcus pyogenes aureus*.

The symptoms are those of an acute pain referred to the epigastrium, with other symptoms of localized inflammation and with the rapid development of leukocytosis. Its accurate diagnosis is at all times difficult, and is best treated surgically by an exploratory incision.

GASTRODUODENAL ULCERS

Authors differ in their statistics of the occurrence of typical gastric ulcer as shown postmortem either by its presence or by the scars which it has produced. Some put it so low as 5 per cent. There can be no doubt that the figures vary in different localities, but it is common enough everywhere. Notwithstanding both its frequency and the definiteness of the anatomic characters of these ulcers, there is no more agreement about their causation than there is about the etiology of malignant diseases.

The reason for this is due to the fact that such an ulcer cannot be produced artificially, a fact which should not be forgotten in discussing its pathology. If only we could experimentally cause one of these ulcers to begin and then go through all its stages by measures of our own, the problem would be well nigh solved. But experimental lesions of the gastric walls, such as Lauder Brunton caused by small ligatures, or, in fact, any other injuries to them, whether designed or accidental, heal as quickly as similar lesions do on the surface of the body. Whatever the nature of these lesions, they never produce a typical gastric ulcer. That the caustic gastric juice, so commonly assigned as the cause of the persistence of ulceration, when once a lesion happens in the gastric mucosa, has really little to do with it, is shown by artificial ulcerations healing just as surely whether there be gastric juice present or not.

Such being the case, many theories on this subject must be expected. Thus, in Dr. C. F. Martin's able article on gastric ulcer in Osler's "System of Medicine," I have counted thirty-six different theories propounded by sixty-two authors, with the agreements on any one statement numbering only nine. Other writers on diseases of the stomach, such as Boas, Hemmeter, Ewald, and Einhorn, increase the list of both discordant theories and of disagreeing writers.

This subject, in fact, is closely bound up with the question why the healthy stomach does not digest itself, which it quickly does when sudden death occurs shortly after a meal is taken. The old view of Hunter that living tissue cannot be thus digested because of its being living, was seemingly disposed of by Claude Bernard, who caused a living frog's leg to be wholly eaten away by introducing it into the gastric fistula of a dog. He also produced the same result by introducing the living leg in a vial filled with artificial gastric juice, and he, therefore, concluded that the effect was solely due to the chemical action of the hydrochloric acid in the secretion. But this leaves the question just where it was, for if a live frog's leg can be eaten away,

either in a fistula or in a vial, why does not this active juice eat a hole through the stomach every time it is secreted in us?

But the same question arises in the case of the pancreatic secretion, which certainly is active enough to digest anything which the gastric juice can digest. Some writers infer that as the usual location of duodenal ulcers is above where the pancreatic secretion flows into the intestine, it is, therefore, still the gastric juice discharged through the pylorus which produces duodenal ulcers. But, as we have shown that the gastric juice cannot itself produce gastric ulcers, it is less likely it can cause ulcers in the duodenum. Moreover, cases have been reported of gastric ulcers in young infants and even in antenatal cases, where, of course, no flow had yet occurred, either of gastric or pancreatic secretion. In addition, we may refer to those duodenal ulcers which occur after extensive burns of the skin, and which must be due to very different causes from those of typical gastric ulcers.

We may now quote further illustrations of the perplexity which this problem causes among authors. Thus, Strümpell says: "It is not known what the special causes are which occasion the primary damage to the (stomach) tissue, nor why the loss of substance is not at once healed, but extends in width and depth. While there is no lack of theories to solve these questions, explanation of the fact that the normal gastric mucous membrane is not attacked by gastric juice lies in the intrinsic vital resisting power of the normal living cells. In a word, our present knowledge of the development and extension of gastric ulcer is very limited." Hemmeter says: "The question of the exemption of the stomach from self-digestion remains unanswered. When Hunter over one hundred years ago (1786) referred the immunity to a specific property of the living cells, 'the vital principle,' he gave as good an explanation as any given up to date."

Howell says: "When we come to consider all the evidence, nothing seems clearer than that the protection of the living tissue is in every case due to the properties of its living structure. So long as the tissue is alive, it is protected from the action of the digesting secretion, but the ultimately physical or chemical reason for this is yet to be discovered."

At this point it seems to me that a ray of light has been thrown on this obscure subject by a remark of Prof. Halliburton when he says: "Recent studies on the important subject of immunity have furnished us with a key to the problem (*i. e.*, why the stomach and the duodenum as well are protected from self-digestion). Just as poisons from without stimulate the cells to produce antitoxins, so harmful substances

produced within the body are provided with antistances capable of neutralizing their effects, and for this reason the blood does not clot within the blood-vessels. Weissland has shown that the gastric epithelium forms an antipepsin, and the intestinal epithelium an antitrypsin, etc.

This has lately been put to practical use in treatment with markedly beneficial results. Thus, Dr. E. C. Hort, of London, has been successfully treating these ulcers by inducing a condition of immunity of the gastric mucosa to the action of those gastrolytic toxins, which first cause and then render permanent the ulcers. Dr. Hort was first led to these views by the success of Dr. Emil Weiss, of Paris, in the treatment of hemophilia and of severe hemorrhages occurring in purpura by the administration of fresh animal serum. This is now becoming a well-recognized procedure in various forms of hemorrhage. Thus, the author, lately treated a lady aged forty-eight, who, beginning with large extravasations of blood under the skin in various parts of the body, had her life threatened by profuse hematuria. Every means for checking the bleeding, including the free administration of calcium salts, failed until 15 c.c. of rabbits' serum were given hypodermically once a day, whereupon the general hemorrhage stopped and the hematuria ceased.

Dr. Hort says that he has uniform success in arresting severe hematemeses with normal horse serum given by the mouth, and equally so with cases of chronic gastric ulcer without hemorrhage in the consequent subsidence of the symptoms, like pain and vomiting. Among his reports are those of a case of severe recurring ulcer during seven years, in which for two days 10 c.c. of normal horse serum were given by the mouth in milk. No other treatment was followed except increasing the serum doses daily, so that on the twenty-seventh day 30-c.c. doses were administered, after which the patient wholly recovered.

In short, Dr. Hort's treatment of gastroduodenal ulcer is to administer not less than 30 c.c. of horse serum a day, beginning with from 10 to 15 c.c. at a dose by mouth in milk, or in $\frac{1}{2}$ oz. of water, and never on an empty stomach. If the pain is severe or there is hemorrhage, from 60 to 80 c.c. may be given in twenty-four hours, the treatment to continue for six weeks or longer. It is best to continue it for some weeks after apparent cure.

The further progress of a gastroduodenal ulcer varies widely in different cases. In many the contiguous mucous membrane proliferates a granulation tissue, which fills up the ulcer and soon heals. In other cases distinct inflammatory processes occur, around the walls of

the ulcer, so that when it heals it leaves a permanent scar. In other cases very chronic inflammatory conditions occur, so that the resulting ulcer may not heal, but persists for an indefinite period. These ulcerative processes may extend widely, with serious results, according to their site and depth. Thus, not uncommonly the canal of the pylorus may become stenosed by the contraction of the cicatrices caused by the ulcerative process, with subsequent dilatation of the stomach. In a few cases these inflammatory processes may encircle the stomach, and produce by their contraction what is termed an "hour-glass stomach." More frequently, however, the ulcerative process extends to contiguous parts and produces adhesions between the stomach and surrounding tissues. This is particularly the case when the original site of the ulcer was close to the pylorus.

The extensive experience of surgeons shows that ulcers of the duodenum are fully as common as those of the stomach, and with the difference that duodenal ulcers occur more commonly in men than in women. Duodenal ulcers also are more prone to end in perforation than gastric ulcers. Surgeon D'Arcy Power, F. R. C. S., reports 3 cases admitted to St. Bartholomew's Hospital in the month of June and a fourth case in the following month. In 3 of his cases perforation occurred without any warning, the patients being at work at the time of its occurrence. Their lives were saved by a prompt removal to the hospital, and then by immediate operation. This shows the necessity of careful watching of the symptoms in this form of ulceration. If the case has been at all chronic, the symptoms already described are sure to be present.

These ulcers, both in the stomach and in the duodenum, often cause fatal hemorrhage by penetrating the coats of an artery. On the other hand, the ulcer is often quite chronic and then of much larger size, the margin is not sharp, with the edges indurated and the border sinuous. In other words, extensive inflammatory changes may occur both in the ulcer and in its immediate surroundings. In such cases the floor may involve the deeper layers of the mucosa or the muscular layers, or quite frequently invade neighboring organs, thus attaching them to the stomach. According to the extension of this process, a superficial ulcer may fill up and leave nothing but a smooth scar, but in the larger ulcers just described the cicatricial contraction may cause serious changes, the most important of which is narrowing of the pyloric orifice and consequent dilatation of the stomach. These large ulcers may persist for years without any attempt at healing.

Modern surgical experience has greatly increased the frequency

of the incidence of gastroduodenal ulcerations, proving, among other things, that the duodenal ulcers occur much oftener in the male than in the female. As to sex, the largest number among females occurs between fifteen and twenty-five, and among males between forty and fifty. Of the gastric ulcers, 90 per cent. are found at the pyloric end, while nearly all duodenal ulcers are close to the opening of the pylorus. They may, however, occur anywhere on the walls of the stomach, more frequently on the lesser curvature and posterior wall.

CHRONIC GASTRODUODENAL ULCERS

The further course of these ulcers greatly varies in different cases. In many patients the ulcerative process becomes chronic by having engrafted upon it distinctly inflammatory processes; the margins of the ulcers become greatly altered from infiltration of the products of the chronic inflammatory processes, and may extend so that the ulcer presents very little resemblance to the simple round and clean-cut lesion at the beginning. In some cases healing takes place, with the presence of cicatricial tissue, leaving a permanent scar over the site of the ulcer. In other cases the ulcerative process extends more widely and deeper, until not only all the coats of the stomach itself are involved, but extensive adhesions may occur to perigastric tissues. This is notably the case in ulcers situated near the pylorus, whose canal may be so diminished by cicatrization as to produce serious obstruction to the discharge of the gastric contents into the duodenum, with consequent dilatation of the stomach itself.

The **symptoms** of duodenal ulcers ordinarily differ from gastric ulcers in the following particulars:

Pain after eating does not occur so often as in gastric ulcers, but usually from two to three hours after a meal. So often is this the case that it has received the name of "hunger pain," which is further emphasized by the fact that it is often relieved by taking small quantities of food. The site of the pain and tenderness on pressure is oftener to the right of the median line, and rarely radiates to the back, as in the case of gastric ulcer. Nausea and vomiting also are rare in duodenal ulcers.

Hemorrhage, on the other hand, in duodenal ulcers may commonly take the form of melena, though it may be concealed and detected only by examination for occult blood in the feces. As in the case of gastric ulcers, duodenal ulcers may be very chronic and lead to cicatrization, with consequent symptoms difficult to distinguish from those of pyloric obstruction. When these ulcers are very chronic and are

not relieved by medical means, a surgical excision is indicated, for in no conditions has modern surgery proved more successful than in dealing with such ulcerations in the alimentary canal.

Treatment.—Dr. R. C. Kemp, in his book on "Diseases of the Stomach, Intestines, and Pancreas," 2d edition, page 346, highly recommends the employment of gelatin in conditions of hyperchlorhydria and in ulcerative conditions of the stomach. He states: "I have found gelatin an excellent remedy, employing 1, 2, or even 3 oz. of a 5 to 10 per cent. gelatin solution, flavored with a pinch of sugar or a little vanilla, and given midway between meals.

Hemorrhage from gastric ulcer varies so much in degree that its treatment must be managed accordingly. In most cases perseverance with a resorcin mixture, given heretofore, and the bichromate pill, may be quite sufficient, along with absolute rest in bed and temporary abstinence from all food. In other cases the hemorrhage is so profuse that other measures must be adopted, the first place being given to Lenhartz's treatment.

Lenhartz believes that many cases of gastric ulcer do not definitely improve, or but very slowly, under the method of entrenched milk feeding; that the high acidity is not measurably lessened; and that if patients are in a poor physical condition, consequent upon one or more hemorrhages, often, indeed, in collapse, the "starvation treatment"—the ice and nutrient enemata and insufficient milk feeding following—not only maintain the patient in his anemic state, but may even drag him into serious inanition, and such an undermined constitution hardly favors the speedy healing of an ulcer. Frequent nutrient enemata excite the gastro-intestinal tract into peristaltic activity, and may thus induce renewed bleeding; besides, very little nutriment is, after all, obtainable.

Should more milk be given by mouth, merely enough to preserve the body-weight—three liters for an adult—it would overfill the stomach and stretch its walls, thus preventing a contraction of the ulcer and again offering the danger of renewed bleeding. Lenhartz advises another dietary treatment, one that will especially combat the hyperchlorhydria and reinforce the enfeebled and anemic state of the patient.

The concentrated egg-albumen diet was tried. In case after case the effect proved so gratifying that this method became the routine treatment. The sour regurgitation subsides, the vomiting immediately ceases, the pain and distress after eating, within a few hours to a few days, disappears, and finally an increase in the body-weight is manifest

as early as the first week. Besides, the improvement is comparatively rapid, so that the patient can be dismissed as cured within a briefer time than formerly.

The following is the tabulated regimen: "Absolute rest in bed for at least four weeks. All mental excitement to be avoided, an ice-bag being placed on the stomach and kept there almost continually for two weeks. This prevents gaseous distention and promotes contraction of the stomach walls, thus tending to obviate hemorrhage, and eases the pain when present. On the first day, even when a hematemesis has occurred, the patient receives between 6 and 9 oz. (200 and 300 c.c.) of iced milk, given in spoonfuls, and from 2 to 4 beaten raw eggs within the first twenty-four hours. At the same time bismuth subnitrate is given twice or thrice a day, 30 gr. (2 grams) per dose, and continued for ten days. The eggs are beaten up entire (with a little sugar), and the cup containing them is placed in a dish filled with ice, so that they remain cold. This food at once 'binds' the supersecreted acid, and, therefore, mitigates the pain rapidly and causes the vomiting, often quite troublesome, to cease. The fat which is present in the egg yolk also inhibits the secretion of hydrochloric acid. The portion of milk is increased daily 3 oz. (100 c.c.), and, at the same time, 1 additional egg is given, so that at the end of the first week the patient is receiving 25 oz. (800 c.c.) of milk and from 6 to 8 eggs. Both these foods are now continued in the same amount per day for another week. No more than 1 liter of milk a day is allowed at any time. Besides milk and eggs, some raw chopped meat is given from the fourth to the eighth day, usually on the sixth, 9 drams (35 grams) per day, in small divided doses (stirred up with the eggs or given alone); the day after, 18 drams (70 grams), and later, possibly more, if well digested. The patient is now able to take some rice, well cooked, and a few zwieback (softened). In the third week quite a mixed diet is tolerated, the meat being given now well cooked or lightly broiled."

All heavy foods are interdicted, as well as vegetables with husks, and those tending to produce flatulence. The patient is given strict orders to masticate his food thoroughly.

The bowels are not moved, both in order to avoid any peristaltic irritation and to permit the reabsorption of blood that may have passed into the intestine. One need pay absolutely no attention to constipation in the first week, even in many cases to the end of the second. After the second week the bowels are moved with small glycerin injections or warm water, and after the third week this is done daily if the movement does not occur spontaneously. After this, one tries

to control the bowels by means of the food and by getting the patient to go to stool regularly.

For the anemia iron is given in the form of a soft preparation of Blaud's pills:

R_y. Ferri sulphatis 10.00 gm.;
 Magnesiæ ustæ 1.75 gm.;
 Glycerini gtt. xxx (3.6 gm.).—M.

Ft. pil. lx.

Sig.—Two pills to be taken two or three times a day.

The pills are given as early as the sixth, eighth, or tenth day of treatment, according to need, administering them first in a macerated condition.

In severe cases arsenic is also given in the form of "Asiatic pills," each containing 0.0001 gm. of arsenous acid. The dose is gradually increased, three for three days, four for four days, up to seven for seven days, then decreasing again, six for six days, etc. After the tenth day and to the sixth week, bismuth compositum is substituted for the subnitrate and given three times a day before meals. The patient is usually allowed up on the twenty-eighth day and is dismissed in the sixth to the tenth week. Lenhartz reports only 8 per cent. of recurrent hemorrhages after this method of treatment, as compared with 20 per cent. of the older methods. No unfavorable results were produced (Kemp).

From the preceding results it can readily be inferred that the treatment of gastroduodenal ulcers is both medical and surgical. The indications for surgical treatment are as follows: "(1) For perforation. (2) In the chronic indurated ulcer. Experience has shown that after gastro-enterostomy the ulcer heals rapidly, and in some cases the ulcer itself may be located. (3) In all cases when the ulcer has caused mechanical interference with the passage of the gastric contents. (4) In all cases associated with recurring hemorrhages. In young girls, a single severe attack of hematemesis may be a simple gastrorrhæxis, or from a simple ulcer that heals readily, but in men severe hematemesis is almost always from the chronic ulcer. (5) In the perigastric adhesions after chronic ulcer, operation is sometimes helpful. (6) In chronic cases in which medical treatment fails to give relief" (Osler).

In all ulcerative conditions of the stomach belladonna ($\frac{1}{4}$ gr. of the extract) may be added three to four times per day.

ACUTE GASTRIC DILATATION

This often occurs in the convalescence from the specific fevers, but notably from pneumonia. As a rule, in such cases the stomach relieves itself by the vomiting of large quantities of fluid. It becomes, however, a serious condition if the duodenum is also involved, when the symptoms may be those of collapse. Thus, such conditions not uncommonly follow operations, particularly laparotomy, in which anesthetics have been used. Of 102 cases collected by Lewis A. Conner, 42 followed operation under general anesthesia.

Treatment.—In cases occurring in convalescence from pneumonia or other febrile affections, I have found great relief by hypodermic injections of eserine, or the active principle of physostigma, or calabar bean in doses of $\frac{1}{50}$ gr.

In those cases that follow operations with the use of anesthetics prompt relief may come from the use of the stomach-tube, with lavage and a change of posture of the patient to the knee-elbow position.

CHRONIC GASTRIC DILATATION

Affections of the stomach producing dilatation may be best understood by first recalling what are the normal functions of different parts of the stomach. Those parts may be divided into three regions: first, the fundus; second, the intermediate part; and third, the pyloric end. The fundus is that part of the stomach which is directly below the entrance of the esophagus. In this part there is considerable delay of the starchy elements of food, which delay allows the action of the saliva mixed with the food to produce the first change in the starchy elements toward the formation of glucose, which change is afterward completed by the ferments entering the duodenum from the pancreas and the liver. It is in the intermediate portion that the gastric juice is secreted, which contains dilute hydrochloric acid and pepsin, of special service in the digestion of the protein substances of the food. The third portion, or the pyloric end, acts somewhat after the valvular fashion, the pyloric canal not dilating until a certain quantity of the gastric contents, formerly called the chyme, has accumulated, when the pyloric canal relaxes and propels the fluids into the duodenum.

When the stomach is really empty it contracts upon itself and has no resemblance to a cavity such as is usually represented in pictures, but, on the other hand, it is extremely distensible, and in conditions of muscular atony of its walls the line of its lower curvature may fall much below the umbilicus, when it can be mapped out by the person

standing and swallowing a quantity of water. Normally, the circular fibers of its muscular coat are constantly contracting, so as to propel forward the stomach contents from left to right until they meet with the band which surrounds the pylorus. This band may contract so firmly, as, for example, during the act of vomiting, that the contents of the stomach are shut off entirely from the rest of the alimentary canal. During digestion a pyloric band can be felt in thin persons much like a tumor, and its relaxation can then be noted by a sense of movement or even of gurgling through the canal. Solid food may remain for from three to four hours in the stomach, being gradually dissolved and propelled from the fundus onward. These movements, however, may be delayed either by weakening of the coats of the stomach by gastritis or by simple atony of its walls. In some cases of gastritis the gastric walls still remain strong enough to force the contents into the pyloric canal. Usually, however, in these conditions there is more or less dyspeptic disturbance referred to the epigastrium. In other cases the atony is so pronounced that the fluid contents accumulate and dilate the stomach until it is removed by the vomiting of its contents in large quantities, which may then be considerably altered in their nature and composition, sometimes acid and containing various bacteria or fungus growths, such as the *Sarcinæ ventriculi*, found abundantly in the vomitus accompanying wasting diseases, such as tuberculosis or cancer. Often, however, gastric dilatation is caused by ulcers formed in the stomach walls, with the resulting contracting cicatrices which produce constriction of the pyloric canal. These frequently occur from chronic irritation of the bile-passages produced by gall-stones, and also by cancer developing in those passages from a chronic irritation of gall-stones, but, however produced, their mechanical effect in contracting the pyloric canal is to interfere with the stomach emptying itself, with the result of true gastric dilatation.

Treatment.—In all forms of gastric dilatation the most efficacious treatment is by gastric lavage, or washing out the stomach, a procedure which is by no means difficult of execution and, in fact, is often resorted to after a little practice by the patient himself. This procedure is best resorted to in the morning before breakfast. It shows its benefits especially in conditions of weakening of the gastric walls from chronic gastritis, whatever its origin. It is often surprising what quantities of mucus are by this means removed from the stomach. The presence of large quantities of mucus in the return fluid of the lavage is an unmistakable evidence of the existence of true gastritis, with its results of arresting digestive power in the glands of the stomach, and with diminu-

tion in the antiseptic properties of the gastric juice, resulting in fermentation of the gastric contents. Repeated lavage of the stomach may be performed every night on retiring, and it has often cured most obstinate cases of stomach derangement. Gastric lavage, in fact, affords great relief in such a grave disorder as gastric cancer itself. In this affection there is an actual diminution, if not entire absence, of the hydrochloric acid of the gastric juice, leading ere long to incurable ulceration with extravasation of blood, and with that decisive symptom of vomiting of "coffee-ground fluids" caused by altered blood. The cicatrization occurring after ulcers of the stomach wall may even produce a contraction of its cavity, so that it is called an "hour-glass stomach."

If the medicinal remedies recommended for the treatment of gastritis and the employment of lavage equally fail, a recourse to surgery should no longer be delayed, because gastro-enterostomy properly performed is often of the greatest avail in otherwise hopeless cases.

HYPERCHLORHYDRIA

It is not often that glandular tissues secrete more than is needed for their normal purposes. To this rule the acid gastric juice may show a striking exception. Cases occur in which both the quantity and the acidity of the secretion is much in excess of all requirements for digestion, with consequent discomfort or distress in the stomach. This is because the gastric secretion depends so intimately on nervous or even on purely mental states.

This purely mental effect was shown in an experiment by the Russian physiologist Pawlow. Two dogs were fed with the same quantity of meat through a gastric opening in each. One dog saw a piece of meat hanging before him, but was not allowed to take it. In the course of an hour and a half this dog was found to have digested five times more of the meat in his stomach than the other dog who meantime saw no meat.

This dependence of the acid secretion of the gastric juice upon purely nervous or even mental stimuli explains the great variety of conditions in which hyperchlorhydria is found. The first of these which we have mentioned is the reflex effect produced by gastric ulcers, which are notoriously likely to occasion excess of gastric secretion. Surgical experience shows that we can never be sure, when the symptoms associated with hyperchlorhydria develop, we may not already have a gastric ulcer present. Another factor is the coexistence of neurasthenic or nervous disorders in the patients. Thus, chlorotic young

women are peculiarly liable both to ulcer and to hyperchlorhydria. But hyperchlorhydria frequently occurs also among men who are subjected in their business to repeated nervous strains, such as brokers and speculators in the money market. In fact, persons of both sexes who are much subject to the worries of life often consult the physician about symptoms indistinguishable from those found in the victims of functional nervous stomach disorders.

The presence of gastric hypersecretion can only be determined by an examination of the stomach contents, such as a test-meal recommended by Ewald. Sometimes this examination shows that not only is there an excess of acid gastric secretion after eating, but that there is a quantity of acid gastric juice accumulated in the empty stomach as well, to which the term "gastrosuccorhea" is applied.

Symptoms.—The symptoms of hypersecretion, unlike those of many cases of ulcer, do not set in soon after a meal, but usually two hours or more after eating, when the patients complain of a sense of weight and then of distress, if not of positive pain at the epigastrium. This region may become quite tender to pressure, but more commonly it is a diffused soreness which spreads without definite restriction to the left. If these symptoms continue severe the patients have eructations of a very sour fluid from the stomach, accompanied by sensations of heart-burn behind the sternum. Vomiting is not common, but when it does occur it gives relief. Headaches are very frequent, and in chronic cases there may be much depression of spirits. The patients rarely show any failure of nutrition, and the external signs are limited to those of the most woebegone expression of dyspepsia.

Treatment.—The first indications of treatment are to neutralize the gastric hydrochloric acid by proper diet. On this account starches should be as much as possible excluded or diminished in quantity. Proteins, on the other hand, directly diminish the acidity by combining with the acid contents. Meats, therefore, are indicated, but should be cooked in a way which would make them easily digested. Thus, slightly broiled meats are easier digested than when boiled. The stomach should never be overloaded with anything, and it is much better to have, besides the ordinary three meals a day, smaller meals taken between times, because in hyperchlorhydria the motility of the stomach walls is often increased, so that food is passed through it more rapidly than in health. It is striking to note how all symptoms or conditions quickly subside on taking something to eat. The diet, therefore, should be meats like mutton chop, moderate slices of steak, one but not two eggs at a time, fish, and poultry, taken with quite crusty bread

and butter. On the other hand, organic acids, such as lemon or vinegar, should be but sparingly used. Potatoes, preferably stewed in milk and cut up fine, will nearly always agree, and many persons can take very thin slices of toast baked again in the oven. Coffee, as a rule, is not well borne except when much diluted with milk. Excessive tea drinking is very injurious. Medicinally, I much prefer the resorcin and the bichromate pill, recommended previously for gastritis, to the free use of alkalis. The alkalis do not deal with the disease, but only relieve temporarily the acid condition, and too great reliance upon them may lead to actual weakening of the digestive powers. Much the best prescription for this purpose is the wineglassful dose of equal parts of milk and lime-water, which may be taken at frequent intervals. On the other hand, bismuth is of decided service in doses of from 10 to 20 gr., with 2 gr. of thymol, after meals and at night. I have found also a powder consisting of 10 gr. of subcarbonate of bismuth and 10 gr. of powdered columbo, three times a day, half an hour after meals, very serviceable. It should be borne in mind, however, that these patients are very subject to constipation, which in their case is best treated by adding from 1 to 2 gr. of powdered rhubarb, three times a day, mixed with the other powders which they are taking.

Normally, the stomach is never empty, for if it has no contents it then contracts upon itself. Dilatation of the stomach, therefore, is always morbid. When food or drink enters the stomach, digestion and absorption differ in different parts of the gastric cavities. The food, as a rule, sojourns for three or four hours within the cavity of the stomach, the fundus then having to do with its digestion. The contents of the stomach in the fundus are effected by the continuous action there of the saliva mixed with the food. The gastric wall of this part of the stomach is in a state of what is called tone, by whose steady contraction the food is pressed forward to the middle of the gastric cavity, where it encounters the acid gastric juice, which immediately attacks the protein elements of food by its combination of the hydrochloric acid with the enzyme called pepsin. As these elements are gradually digested the liquid product is propelled to the pyloric canal or sphincter, which, at the end, periodically relaxes and allows the acid chyme to be passed into the duodenum. It should be mentioned that water is not absorbed from the stomach, but is passed into the intestines. Dilute alcohol, however, may be absorbed directly from the stomach, but only a minute portion of the saccharine elements are thus taken up, the rest being passed on to the duodenum. The fats are here not absorbed at all, but may be partially emulsified

during the gastric movements, but are more commonly passed on unchanged into the duodenum.

ACHYLIA GASTRICA

Atrophy of the mucous membrane of the stomach has its chief cause in chronic obliterative gastritis, produced by the constant swallowing of micro-organisms from the roots of decayed teeth, as we have mentioned in our remarks on Oral Sepsis. This condition may not only involve gastric secretion, but also intestinal digestion as well. That atrophy of the mucous membrane of the stomach can occur spontaneously, as supposed by Fenwick, appears to me improbable. Examination of the contents of the stomach after a test-breakfast shows the absence not only of the normal secretions, but equally so of the pepsin and rennet. One of the results of such a state of the stomach would easily be mistaken for pernicious anemia, but examination of the blood shows in these patients only the conditions of severe secondary anemia.

In many cases achylia gastrica occurs as a temporary condition produced by proptosis of the stomach and bowels, and may then be relieved by measures proper for such a condition. It is conceivable also that it may occur from chronic nervous derangements, as in neurasthenia, and be relieved by appropriate treatment.

' **Treatment.**—As this condition is characterized by absence of the digestive secretions of the stomach, we should attempt to supply the deficiencies artificially by administering dilute hydrochloric acid, 15 drops, with 10 gr. of saccharated pepsin at each meal. The occasional addition of 2 to 3 drops of Fowler's solution of arsenic may also be beneficial.

ACHLORHYDRIA HÆMORRHAGICA GASTRICA

The stomach is often affected owing to reflex causes. An example of this condition is found in the entire absence of HCl in the gastric juice due to chronic appendicitis. In other cases the source of the reflex arrest is from irritation of gall-stones, but, however induced, the tendency is to chronic inflammatory conditions in the gastric mucosa, which in chronic cases may lead to erosions in the mucous membranes with actual hemorrhage. This hemorrhage may never amount to hematemesis, but may be found upon examination of the feces. It is remarkable how long the symptoms may persist in some cases of chronic appendicitis, and then be cured by removal of the appendix; in other cases by operations on the pylorus for constrictions

caused by gall-stone inflammations. The diagnosis is best made by examination after a test-meal revealing the absence of HCl in the stomach, and when the trouble is evidently dependent upon the chronic appendicitis or cholelithiasis these cases are best treated surgically, as will be hereafter noted.

Gastrostaxis.—"Under this name Hale White describes cases of hemorrhage from the stomach in young girls without any lesion of the mucosa. They are often mistaken for ulcer. He has collected 29 cases. Surgeons have taught us that the condition is by no means uncommon. At operation the blood has been seen oozing from points in the mucosa. There may be no pain or any of the ordinary features of ulcer" (Osler).

FOREIGN BODIES

These may be found in the stomach in immense numbers among insane persons. Cases have been reported in asylums who have had to be constantly watched lest they should swallow every variety of solid articles. In one case reported by Vandivert and Mills from State Hospital No. 2, St. Joseph, Missouri, 1446 objects were found. Neither emetics nor cathartics should be given in such cases, cathartics especially, because of the liability to injure intestinal walls by the hard or sharp substances. Usually constipating food, such as potatoes, rice, etc., should be taken, in order to keep the bowels costive for a few days, thus forming a protective mass about the foreign body. When the nature and size of this accumulation is revealed by x-ray examination, a surgeon should be called in to perform gastro-enterostomy.

INTESTINAL DISORDERS

DIARRHEA

In considering derangements of the intestines the old terms "diarrhea" and "dysentery" still hold their places better than any of the more recent names applied to these disorders. Thus, it is a mistake to designate diarrhea an intestinal catarrh, because that implies an inflammatory condition in all cases; whereas, in the deadly Asiatic cholera, no inflammatory process initiates it, for inflammatory conditions supervene, if at all, only as late results of the primary infection. Equally so, dysentery is not always a colitis, for some, and by no means the least severe, of these affections involve the rectum only and not the colon.

The term "diarrhea" is well defined by Sir Lauder Brunton, who writes: "The name diarrhea is properly used to indicate the fluid and too frequent discharge from the bowels." One of the commonest causes of diarrhea is improper food, well illustrated in the ordinary forms of diarrhea in infants. As they have to live entirely upon milk, the milk itself is often the cause of their diarrhea, because it is not as well adapted to their digestive powers as is breast milk. We see this frequently exemplified in the difference between bottle-fed and breast-fed infants. But likewise in adults, severe diarrhea may supervene upon partaking of improper articles of diet.

The forms as well as the nature of diarrhea are very varied. One form is interesting because it illustrates the difference between the functions of the small intestine and those of the colon. This is found in the early morning diarrhea of some patients, who often have copious discharges, beginning as soon as they wake up in the morning, but ceasing afterward, without troubling them during the rest of the day. On the other hand, attacks of colitis are frequently wholly suspended by rest in bed, or they come on only after taking food or while walking about.

Again, looseness of the bowels may be caused by conditions in other organs, especially in cirrhosis of the liver and in heart disease. Cirrhosis of the liver is often the cause of very intractable diarrhea, which is readily explained by the venous congestion of the whole intestinal tract set up by obstruction in the portal circulation. In the same way heart failure may cause general congestion of the intestinal wall and consequent diarrhea. Diarrhea may also occur in the course of specific fevers, when these are accompanied by local ulcerative processes in the intestine. This is illustrated in ulceration of Peyer's patches in typhoid fever, and also in the terminal diarrhea of tuberculous patients. Diarrhea may be initiated by fermentative changes in a dilated stomach, when long-retained secretions instead of being vomited are passed into the duodenum.

We shall begin, therefore, with what may be properly termed *intestinal catarrh*, due to the presence of improper food. In some cases this may be caused by too great an amount of food being taken at one time to be easily digested. As before remarked, the normal secretions of the alimentary canal have two offices: first, digestive; second, antiseptic. When they fail in this latter respect, the food ferments and becomes locally irritant to the intestinal walls. An abundant secretion thereupon flows from the intestinal walls, but as normal absorption is now delayed, the intestinal contents ferment, and produce

severe irritation of the mucous membrane. The *symptoms*, then, in contrast with those of choleraic diarrhea, are accompanied with griping pains, and in some cases with moderate fever. The indication then is to empty the bowel of its contents, which may best be done by use of 5 gr. of calomel for an adult, combined with 30 gr. of compound jalap powder, after which action the diarrhea usually subsides. In some cases, however, the irritation of the mucous membrane does not subside, but the diarrhea continues.

Treatment.—The best means then is to use a combination of remedial astringents along with sedatives to diminish the peristalsis. For this purpose I have found a modification of Hope's mixture very serviceable, according to the following formula:

℞. Acidi nitrici dil..... ʒiiss;
 Tinct. camphor. }
 Tinct. opii } āā ʒiss;
 Syrup of ginger..... ʒiss;
 Peppermint-water..... q. s. ʒvj.—M.

Sig.—One tablespoonful of this every three or four hours.

In the diarrhea of children from similar causes I have found Dr. West's prescription much the most serviceable:

℞. Magnesium sulphate..... ʒj;
 Tinct. rhubarb..... ʒij;
 Syrup of ginger..... ʒj;
 Liquor menthæ..... ʒv.—M.

Sig.—Teaspoonful three times a day.

We have already, in our remarks on typhoid fever, spoken about the prevention of diarrhea in the treatment of that infectious disease. This diarrhea, in fact, ought not to be allowed to continue, as it so depletes the patient. Much of the emaciation, therefore, which commonly occurs in this fever can be wholly prevented.

Tuberculous ulceration of the intestine may be very local, and then give rise to both hemorrhage, which may be its first symptom, and to diarrhea. The danger of this ulceration is that, unlike the ulceration from typhoid fever, it may produce stenosis of the intestine by its cicatrization, which does not occur as a result of the ulcerations of typhoid fever. It is best treated when there is hemorrhage by a pill of nitrate of silver, opium, and the resin of turpentine, recommended in the treatment of hemorrhage in typhoid fever. I never lost a patient from hemorrhage in typhoid fever, but, unfortunately, that did not prevent subsequent perforation; while, on the other

hand, intestinal ulcers of a tuberculous nature but rarely cause perforation. The diarrhea which sometimes accompanies the congestion of the intestine caused by weak heart is best treated by 30-gr. doses of the subcarbonate of bismuth with 3 gr. of thymol, given three or four times a day.

PERITONITIS

The peritoneum is much the largest serous membrane in the body, and when all its folds are spread out, has been estimated by Beau as four times the extent of the skin. In former times inflammation of the peritoneum was regarded as a disease by itself, and was prescribed for accordingly. It is remarkable what a tolerance for large doses of opium occurs when peritonitis is at all general, and I heard a distinguished clinician in a lecture on peritonitis say that if necessary we should give 100 gr. of opium in the course of a day, and only desist upon the appearance of the physiologic effects of opium, namely, contracted pupils and slowness of breathing. At present we regard peritonitis not as a disease, but rather more like a surgical accident, through the penetration into the peritoneum of the products of inflammation or infections outside its cavity. Thus, one of the most dreaded causes of extensive peritonitis is from the bursting of an abscess into it, due to an ulcerated appendix.

We may have a great variety of cases of localized peritonitis, many of these being localized by the early adhesions which are formed between its two layers. It should be remembered that there is no cavity between the layers of a healthy serous membrane, for in health they are always in contact with each other, and a cavity can be formed only by accumulations of gaseous or fluid contents.

Symptoms.—Some of the clinical symptoms that occur in peritonitis, when it is at all extensive, may be mentioned here. First its characteristic pulse, which, besides being frequent, is small and of high tension, a condition found in no other complaint except scarlet fever. The decubitus is dorsal, often with the legs drawn up. The walls of the abdomen are distended, but well-nigh motionless, the breathing being thoracic. Vomiting, however, occurs and aggravates the pain. The gestures of the patient have already been referred to, in that he does not venture to press anywhere on the surface of the abdomen. The bowels, also, are obstinately constipated, as their movements would only aggravate the pain. All of these symptoms should be remembered, because the absence of any of their chief factors strongly militates against the existence of peritonitis. Thus, I was once called in consultation to see a lady for peritonitis, because she complained of

such acute pain upon the slightest touch of the abdomen. I found her lying on her side, and, therefore, pronounced it a case of hysteria.

Another fact should be noted, that not only are the muscular walls of the abdomen motionless, but they are also hard and rigid, this occurring even while it is quite local, as it is in the first stages of appendicitis, when the localized rigidity may be mistaken for a tumor. But these are signs which are common to inflammation elsewhere, as, for example, when a joint is inflamed, like the knee, the muscles supplying the joint are contracted and hard, for the purpose of keeping the joints still.

Inflammations of all the serous membranes are apt to produce adhesions between their two surfaces, which may be very general, as in pericarditis, or extensive, as in pleuritis. The most striking example, however, of localized adhesions occurs in the peritoneum. Thus, in cirrhosis of the liver, even though there be much ascites, which might be expected to separate the two layers, yet after death we often find the coils of the intestine partially matted together in numerous places.

Adhesions of serous membranes due to their inflammations must be regarded as a very important defensive means of nature to prevent what would otherwise be a fatal extension of the inflammation. Thus, gastroduodenal ulcers are usually prevented from causing general peritonitis by the early formation of peritoneal adhesions at their sites, and what is true of these lesions is also the case elsewhere in the abdomen. It is rare, therefore, to find at autopsy a peritoneum completely free from adhesions. Fatal peritonitis, therefore, must be due to the virulence of the infecting organism overcoming the local defensive processes of the system. In some cases this virulence is great enough to prevent the ordinary symptoms of inflammation. I knew an eminent physician of New York, whose death could not be accounted for, until at autopsy he was found to have suffered from a general peritonitis, without any of the ordinary symptoms.

Such cases of virulent infections of the peritoneum with but few signs of inflammation are common in the most dangerous form of general peritonitis occurring in parturient women, and which formerly went by the name of puerperal fever. The infection here occurs by one of two roots, either by the Fallopian tubes, as they open free on the peritoneal surface, or by the lymphatics proceeding from an infective and sometimes putrid focus in the cavity of the uterus. This puerperal infection is usually very rapid in its course, death occurring within a week, commonly setting in by rigors and grave symptoms of constitutional character, but in severe epidemic forms it might run

its course with a few, if any, clinical symptoms of peritonitis, the temperature rising to 105° or 106° F., when death often occurs with symptoms of syncope.

Since the nature of this terrible malady has been demonstrated, modern medical science, by measures of prophylaxis, has made so-called puerperal fever well-nigh extinct, as we have shown at the close of our article on Erysipelas.

Treatment.—The treatment of peritonitis, of course, depends upon its origin, which, as we have remarked, is nearly always of a surgical kind. When, as in cases of appendicitis, an abscess has formed, this should be not only immediately evacuated, but so far as possible the affected parts should be thoroughly cleansed by douches of water at 100° F. Some remarkable recoveries have been reported by this measure after the peritonitis has extended to quite distant parts of the membrane. When the source is within the pelvic cavity the indications are still the same, although the measures may have to be modified according to conditions present in the organs involved. No purulent collection can ever be safely left to itself in the body, but must be evacuated and its cavity drained.

Medicinally, we should have recourse to opium, as already mentioned, but it should be remembered that opium in such conditions does not act by its sedative properties, but rather by its great stimulant effects on the heart. Owing to the relation of the abdominal cavity to general vitality, as we have already mentioned, abdominal affections and, notably, peritonitis immediately depress the heart, and against this depression we have no remedy equal to free doses of opium.

Tuberculous peritonitis we have already referred to.

Peritonitis in children generally occurs from the same causes as in adults, particularly from tuberculosis, as we have already mentioned. Cirrhosis of the liver we have also spoken of as occurring in childhood, and such patients may require frequent tapping. In after-life the coexistence of ascites with jaundice is very suggestive of cancer of the liver.

ASCITES

Ascites, or accumulation of fluid in the cavity of the peritoneum is a very common accompaniment of cirrhosis of the liver, particularly of its atrophic form. Like the mechanism of edema in general, it is not easy to explain in every case the mechanism of the productions of ascites. Owing to the effects of mechanical pressure which it occasions, there may be interference with the functions of the kidneys. Usually it differs from progressive anasarca in either valvular affec-

tions of the heart or from parenchymatous nephritis, in that it does not produce dropsy of the lower extremities, but, however caused, we are often obliged, owing to its mechanical effects, to tap the abdomen and draw the fluid off. This should be done with the patient sitting on the edge of the bed, having previously applied a broad abdominal binder, to be drawn tighter as the fluid escapes, otherwise fatal syncope might occur from a too rapid emptying of the distended abdomen. Previous to introducing the trocar the skin should be carefully disinfected, because otherwise the wound may be infected and erysipelas occur.

Treatment.—In all cases of cirrhosis of the liver, tapping should be resorted to early, because not infrequently the patient may remain for a number of weeks without needing a repetition of the operation.

INTESTINAL MOTILITY

There is no commoner affection of the intestine than alterations in its peristaltic movements. Such changes may forcibly illustrate the remarkable association of the nerves throughout the whole intestinal tract.

Thus, dysenteric irritation of the rectum may cause relaxation of the pylorus, with rapid emptying of the stomach into the duodenum, and so on through the entire intestinal canal, especially in children, so that they become starved to death, for not a particle of food can enter the stomach without its being quickly discharged at the anus. The little patients rapidly emaciate, and have an aged and withered appearance. The proper treatment of these patients is by enemata of laudanum without any starch, carefully graded, however, to the age of the patient, for children are very susceptible to opium. The reliance, however, must be mainly upon the enemata of bromid of potassium, which may be given in from 5- to 10-gr. doses. This is due to the fact that the bromids are the most efficient of all agents in allaying reflex excitability. Milk should be avoided, and instead finely scraped raw meat should be given in half-teaspoonful doses every half-hour.

These facts are also illustrated by the marked clinical contrasts between dysentery, which is an affection of the colon, and diarrhea. In many cases of diarrhea among adults due to affection of the small intestine, the bowel movements do not occur during the night, and only early in the morning. When the lower part of the colon is affected, however, the movements occur directly after eating, and thus constitute a valuable clinical sign of the existence of dysenteric colitis. Sometimes in these cases the patients can recognize in the

stools small particles of food which they have just taken. In not a few instances of this kind an ulceration is present in the lower bowel, and often can be found on inspection with a proctoscope. It is striking to find how these ulcerations may follow as a chronic result supervening upon an acute colitis, occurring while the patient was in a warm climate, and then remaining to torment him for years by the occurrence of local ulceration in the neighborhood of the rectum. It is also in these cases that general infection of the blood by the entrance of the *Bacillus coli* is so common, as before remarked.

Constipation.—The supervision of deficient movement, leading to constipation, is so common that the physician is oftener consulted about sluggishness of the bowels than almost any other infirmity. It should be borne in mind that the only natural remedy for constipation is cellulose, so largely present in all vegetables. This is illustrated in nature by the difference between carnivora, who do not have loose movements, and herbivora, who are never long without semifluid passages. But herbivora are never condemned to a sedentary life, and it is due to the want of assistance by the movements of the abdominal muscles that constipation so frequently occurs in the people of civilized communities. On that account the relief of habitual constipation is no easy matter, for it may call for a permanent change in life habits. Perhaps one of the most effective agents for restoring normal action of the bowels is horseback riding, but this remedy is so unattainable except by a very few, that we must deal with this complication as best we may. First, by insisting upon perfect regularity in attending to the bowel movements. The most natural time for the bowels to be evacuated is just after food has been taken following the longest fast. If, therefore, patients would resort each day at exactly the same time (by the watch) after breakfast, this of itself would frequently result in curing the difficulty, because of the important rôle of habit in all functions, but especially in the functions of the intestinal canal. But we must resort to many other ways, chief of which should be the regulation of the diet. For this purpose the use of fruits is invaluable, as they contain so much cellulose. An orange and a banana, taken at breakfast with a tumblerful of water before any other food, are often quite efficacious. Prunes are a favorite article with many, but some persons find that they disturb the digestion. The frequent employment of figs has the disadvantage that the seeds may accumulate in large masses. Medicinal laxatives of all kinds are to be deprecated, for while some of them, like preparations of cascara, are effective, the intestine soon becomes accustomed to them, so that the

constipation, in the long run, is worse than before. Salines, on the other hand, relieve the bowels with the least expenditure of the patient's strength. A good prescription is a dram of sulphate of magnesium with 1 gr. of quinin, taken in a tumblerful of water on rising. Another good laxative is found in a prescription:

R. Compound extract of colocynth..... 3j;
 Extract of belladonna..... gr. v;
 Liquor. potassæ..... 3ss;
 Pulv. glycyrrhiz.....q. s. —M.

Ft. pil. xx.

Sig.—One to be taken at night.

A nostrum of a vegetable substance imported from Germany and called "regulin" has proved very beneficial in securing natural, but not laxative, movements. It is somewhat troublesome, however, in requiring that it should be administered in teaspoonful doses on some cereal with milk on rising and at night.

ILEUS

This is a form of obstruction of the bowels which is not due to an organic cause. I once had a remarkable case of the kind, which I published in the "Transactions of the New York State Medical Society," in a young woman who was caught in a cold thunder shower while menstruating. This stopped her menses and at the same time caused the most obstinate constipation, along with such borborygmi or rumblings of the intestine that they could be heard across the room. When the bowels were at last moved by a strong cathartic, the movement showed not a trace of ordinary pigment, but looked like lime plaster. Not long afterward she had copious stercoraceous vomiting. After a time the urine suddenly stopped, whereupon the saliva and the tears began to flow very copiously. On testing the saliva with strong HNO_3 , crystals of nitrate of urea appeared, showing that the parotids were taking on the rôle of the kidneys. This vicarious action of the parotids and kidneys continued to alternate at intervals of less than a week for a period of four months, until she died. Postmortem the mucous membrane of the intestine was extraordinarily atrophied, showing little trace of normal glandular tissue.

ENTEROPTOSIS

When one considers the number and the variety of the abdominal organs, on the one hand, and the flexibility of the structures forming the abdominal walls, on the other, it is no wonder that displacement of

abdominal organs is so common. Often such displacement is normal, occurring during the movements of respiration, and equally so in those of digestion. Moreover, in women the growth of the pregnant uterus occasions more displacement of the adjoining parts than would be possible in any other cavity in the body. The particular displacement which forms the subject of this article may include a falling downward of the stomach or the intestines, especially of the transverse colon, and often of the kidneys, until they are packed into the cavity of the pelvis. It can readily be imagined, therefore, what a variety of symptoms—motor, sensory, and secretory—may have their origin in prolapse of these organs, and which can be cured only by mechanical measures which will restore the displaced viscera to their normal positions.

Enteroptosis may exist in a marked degree without producing any symptoms. Usually, however, there is a variety of gastric derangements grouped under the term “dyspepsia,” or intestinal symptoms of various kinds, constipation being very common, with stasis of the intestinal contents, and a number of nervous symptoms directly traceable to auto-intoxication. Local symptoms also may be caused by dragging of the prolapsed viscera upon their attachments. Among these may be mentioned displaced or movable kidneys, which would best be treated in the chapters on Renal Disorders.

All this proves the importance of early diagnosis of this condition, which may be readily demonstrated on inspection of the abdomen. Wholly different from the normal, there is a transverse depression extending across the abdomen, this depression usually being noticeable between the ensiform and the umbilicus. On the other hand, below the umbilicus there is a protrusion of the abdominal walls to which the term “pot-belly” has been applied. Closer inspection will, in thin persons, show that the lesser curvature of the stomach is on a line with or even below the umbilicus. In the dorsal position the viscera fill both flanks. The lower curvature of the stomach can then be mapped out by percussion when a quantity of fluid has just been taken, and this may be further demonstrated by eliciting a splashing sound through the means technically called “clapotage.”

In other derangements enteroptosis is sure to aggravate displacements of the uterus and ovaries, with corresponding symptoms.

Treatment.—In no other set of disorders is the principle so illustrated that derangements of a mechanical sort are best treated by mechanical means. After the prolapsed viscera have been restored to their normal positions, they should be kept there by external sup-

ports. For this purpose all bandages are useless, and in their places adhesive plaster should be used. Far the best of these contrivances is the belt devised by Dr. Achilles Rose, which will be described later. I have known patients who have been so reduced that they were unable to attend to their ordinary duties of life with general impairment of health and nutrition who were restored by the employment of Rose's belt to a condition of excellent health.

Kemp describes Rose's belt as follows:

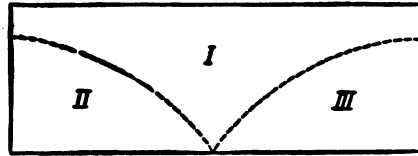


Fig. 1.—Pattern for cutting the Rose plaster abdominal binder: Dotted lines for section.

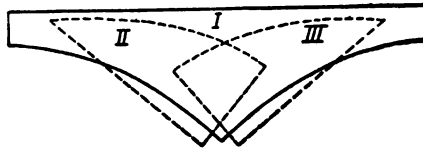


Fig. 2.—Pattern for cutting the Rose plaster abdominal binder: Plaster after section.

“Adhesive plaster, zinc oxid on soft moleskin (Johnson and Johnson), preferably 7 inches wide, though 6 inches can be employed. A yard in length will suffice in most cases. The circumference of each patient should be measured, and the plaster should be long enough to encircle the waist. The plaster is folded over, so that the free ends are in line, and a curved line drawn in pencil from the lower margin of the point where it folds to the free margin, to about 1 inch below the upper border. The plaster is cut along this line, giving three pieces; or the plaster is stretched out and the dotted lines marked, as in Fig. 1, and cut along these lines, giving three pieces, *I* and the two lateral pieces, *II* and *III*, as in Fig. 2.

“*I* is applied to the abdomen, and the lateral pieces, and *III*, overlap in front and are applied to the under plaster. These serve to draw up the abdomen.

“To avoid irritation of the umbilicus I cut a V out of the upper border of the under plaster or invert a small portion of it. The sharp angle below should be cut off to avoid interference with the pubic hair. The curved portions of the lateral wings should look upward and somewhat inward and adhere to the lower ribs. The sharp angles of

the lateral wings at the symphysis may also be cut off to avoid the hair.

"Hair, if present on the abdomen, is shaved, and the surface cleaned with ether or chloroform.

"The plaster is applied with the patient in the dorsal position and, preferably, with hips slightly elevated.

"The plaster should remain on for four to six weeks, depending on the season of the year, irritation (which is rare), or its loosening. It should then be removed, a full bath given, talcum dusted on, and twenty-four hours later a new belt applied.

"Oil of wintergreen, applied to adhesive plaster, aids its easy and painless removal. One can also apply to the plaster a 10 per cent. wintergreen oil ointment (Beardsley, 'Jour. Amer. Med. Assoc.,' Jan. 28, 1911).

"One patient sent me by Wm. H. Thomson, a severe case of splanchnoptosis, wore the belt fourteen months, gained 40 pounds in weight, and was completely cured.

"The device gives brilliant results. The method of support by a pad for the special organ is unscientific.

"Only on occasions when the material for Rose's belt was not at hand have I applied a method with narrow strips of plaster. They overlap at the linea alba in front and at the spine behind. As the final procedure, two transverse strips are applied in front."

INTESTINAL DISCHARGES

We may make here a few observations upon the bacteriology of the intestinal tract. Enormous numbers of bacteria normally occupy the intestinal tract of man and animals. A conception of the number may be gained from the knowledge that Strassburger has found in accurate investigations that one-third of the weight of the dry residue of the feces consists of the bodies of dead bacteria. Strassberger has estimated the daily output at 128,000,000,000. Billroth stated that there are more bacteria in the large than in the small bowel. Systematic examinations show progressive increase in number from the duodenum to the large intestine. The duodenum and jejunum may be entirely free six hours after meals. Under ordinary conditions the bacteria of the feces are practically all dead. The cause of this actual sterilization of the feces has not yet been determined. In morbid conditions of the bowel, however, all this may be changed, and there is no doubt that many states of disease are due to the activity of living organisms which are always found normally in the intestinal tract,

as we have demonstrated in our chapter on Infections by the *Bacillus Coli*.

First, with reference to the diarrhea of children, caused in the first instance by unwholesome food, the most common forms are due to actual infection of the milk by a group of organisms closely similar or identical with the bacillus isolated by the Japanese bacteriologist, Shiga. This has been proved by the researches of the workers in the Rockefeller Institute of New York, such as Flexner, Hiss, and others, who demonstrated the connection of this bacillus with common summer diarrhea, loosely grouped under the head of cholera infantum. This organism attacks the lower bowel, producing distinctly dysenteric symptoms, although at the beginning persistent vomiting may be present. When it is remembered how Asiatic cholera may be communicated by the most insignificant addition of the organism to articles of food, the occasional occurrence of Shiga's bacillus in the discharges from breast-fed children may be easily accounted for, as the majority of these patients is to be found in the crowded tenements of the poor in large cities. The best preventive, therefore, is by boiling the milk, which destroys the pathogenic organisms.

Next to disorders of motility come derangements of intestinal secretions. These are very varied, both in their nature and in their causation.

The simplest of these are those fluxes due to the presence of unwholesome food. This is fully illustrated in the diarrhea of children. The digestive powers of infants are relatively so feeble that their death-rate in the first year is the highest of any subsequent year of life. This is because their mother's milk is their only natural food, and the mortality of bottle-fed infants is a proof of this. Even after dentition is completed the bowels of children are still easily deranged by improper feeding.

But the subject of diet is an important one at all ages, because the commonest forms of diarrhea among adults, whether acute or chronic, are frequently best treated by finding out what kind of food is most suited for the patients.

Yet many intestinal fluxes have nothing to do with food. First among these we would rate infections such as yellow fever and Asiatic cholera, already spoken of, as good examples. Thus the poison of the cholera vibrio appears to paralyze the solar plexus, for the blood is then drained of its serum through the bowels, much as an animal dies following experimental extirpation of the solar plexus.

Other forms of diarrhea follow infections causing intestinal ulcera-

tion, as in typhoid fever and tuberculosis. Both hemorrhage and perforation of the intestinal wall are apt to accompany these lesions.

Obstructions in the portal circulation by cirrhosis of the liver may cause a wholly unmanageable intestinal flux.

Instead of this, we may have death occur unexpectedly from hemorrhage. I knew of a case of cirrhosis in which all the blood of the body seemed to be poured into the intestine without any of it being voided outside. Blood-poisoning in Bright's disease may also destroy life by fatal diarrhea, and it is one of the terminal symptoms of this complaint to have these bowel discharges bloody.

We prefer, therefore, to speak of these various affections as disorders of intestinal secretion rather than under the heading of Catarrhal Enteritis, for many of these affections are in no way associated with inflammatory processes.

One form of diarrhea in children, spoken of under the term of "enterocolitis," is easily controlled by medicines unless, if neglected, the colitis finally takes the form of dysentery. At one time, many years ago, I had charge of the children's class in a leading city dispensary. This class grew so much in numbers that the original quarters had to be enlarged, and was crowded by mothers bringing their children with what would now be termed "enterocolitis." The infants were so commonly relieved by a prescription which I copied from West's "Diseases of Children" that I finally gave the prescription to the exclusion of numerous others given in that book on the treatment of diarrhea. This prescription was:

R̄. Magnesii sulphatis.....	3j;
Tincturæ rhei.....	3ij;
Syr. zingiberis.....	3j;
Aquæ menthæ.....	3vj.

Dose.—Teaspoonful every three hours for an infant one year old. For children from two to three years old the proportions of magnesium and rhubarb to be doubled.

In many cases of diarrhea of adults caused by improper food a composition of rhubarb and magnesia is often of the highest service.

CHOLERAIC DIARRHEA

Much the most serious of diarrheas is the choleraic. It is almost exclusively an affection of the small intestine in its origin and course, and quite distinct in its symptoms from affections of the colon. In some cases of choleraic diarrhea the upper part of the large intestine may become involved by extension, so that a true colitis may supervene,

but this does not alter the fact that originally no choleraic diarrhea begins as a colitis.

The grave feature in all choleraic diarrhea is the tendency of the profuse watery discharges to drain the blood of its serum, so that in this sense the patient may bleed to death. Thus, in severe forms of cholera nostras or cholera morbus the clinical features may be indistinguishable from those of Asiatic cholera itself, the only difference being that the latter occurs as an epidemic, while the former is sporadic and does not show the same bacteriology.

Clinically, cholera infantum is likewise as true a choleraic affection as the Asiatic pestilence itself, and with the same consequences.

Choleraic diarrhea occurs neither spontaneously nor from blood-poisoning, but always from irritation of the intestinal wall by food which is improper in quality or in quantity. It begins, therefore, with symptoms of local irritation, causing cramps or colicky pains. Soon inflammatory changes occur in the intestines, accompanied, in children, by fever, which may range from 103° to 105° F. As we have remarked, serious organic changes may occur in thoracic viscera without causing alarm, but the moment the abdominal viscera are affected, if only by functional derangements, the face wears a woebegone expression. So the first experience puts an end to all cheerfulness, for soon both nausea and vomiting set in. One of the commonest difficulties in the treatment of choleraic derangements is that the stomach refuses to retain anything.

But the chief element in the complaint is the profuse diarrhea. At first the bowel is emptied of its more or less solid content, which may have a very offensive odor, but soon the discharges become watery, and in some instances, particularly in children, tinged with blood. The purely watery discharges are, like the blood-serum, alkaline in reaction.

In choleraic diarrhea, whether in adults or in children, painful muscular cramps occur, shown in infants by the clutching of the fingers and carpopedal contractions of the feet. Soon in children nervous symptoms supervene, like drowsiness or of coma. These are not necessarily toxic, but are dependent upon interference of the cerebral blood-supply. Sometimes, however, such symptoms are truly uremic. It should be remembered that the kidneys become severely affected in all cases of profuse choleraic diarrhea, as they do in Asiatic cholera. On that account, every attack of cholera morbus in an elderly person should be promptly followed by an examination of the condition of the kidneys, otherwise the patient may soon die of

uremia. The best remedy, then, is to have the bowels irrigated by 4 to 6 gallons of hot normal saline solution, and urotropin and sodium benzoate administered as against the *Bacillus coli* infection of the kidneys.

It is curious that if a person has been once attacked with cholera morbus after indulging too freely in some favorite article of food, he ceases thereafter to wish any return to such eating. I knew one person who was very fond of muskmelons, until one night he ate too many of them, when, after the painful experience which followed, he could not indulge in muskmelons for many years. The stomach is an unchristian organ and slow to forget its resentments.

Treatment.—We begin with the treatment of *cholera infantum* because the urgency of the symptoms calls for very prompt action. The first thing to do is to administer hypodermically that most trustworthy of heart stimulants, camphor dissolved in sterilized almond or olive oil. As much as 3 to 5 gr. of camphor should be administered, and repeated in two hours if necessary. The next is to irrigate the bowel by means of a fountain syringe and thoroughly wash out the bowel with 2 to 3 gallons of normal saline solution. This often produces a marked change for the better in the baby. If vomiting persists, lavage of the stomach should then follow, and at the end of this a drop dose of Fowler's solution in water should be given. It is curious for how long particles of the offending food may still be found in the discharges. As soon as possible; therefore, the bowel should be cleared by the administration of a dram of castor oil. If this be rejected, calomel should then be given in divided doses, 1 gr. being rubbed up with sugar and divided into 10 doses, and put on the tongue every five to ten minutes until the stools assume the characteristic green color. The administration of milk should be wholly suspended, and nothing but teaspoonful doses of water that has been boiled should be given every few minutes for more than an hour at a time.

In an attack of *cholera morbus* in adults the first thing to do is to irrigate the bowel as we would in children, and also to use the hypodermic of camphor in oil in a dose of 7 gr. of camphor at a time; also, if the stomach remains irritable, it should be washed out. Should the diarrhea persist, 20 gr. of subcarbonate of bismuth may be administered every hour or two, and in adults there is no objection to the administration of from $\frac{1}{8}$ to $\frac{1}{4}$ gr. of morphin. As above remarked, the state of the kidneys should be carefully watched.

APPENDICITIS

As if we did not have enough ways for dying, the useless organ of the appendix vermiformis seems provided to act as a trap to ensure our removal. In construction it consists of a small narrow tube lined by mucosa which is very prone to catarrhal inflammation, caused by the entrance into it of fecal masses or foreign bodies from the cecum, to which the appendix is attached, and which cannot be easily got rid of simply because at its lower end it is a closed tube. On that account the Mayo brothers, as a result of their extensive experience, say that a healthy appendix is rare.

Appendicitis, therefore, is a common affection responsible for a large number of deaths in all countries, but especially, according to statistics, in the United States. The reasons for some of its proved antecedents are obscure, one of them being the existence of a rheumatic constitution, for more than one case is reported of an appendicitis following closely upon an inflammation of the tonsils, which is such a common antecedent of rheumatic fever. In the majority of cases, however, no definite antecedents can be mentioned, appendicitis occurring in such healthy individuals that no preventive measures can be adopted.

Attention, therefore, cannot be too assiduously paid to the first symptoms of this complaint, of which localized pain is of leading importance. The onset of this pain is commonly sudden, and usually, but not always, definitely localized in the right iliac fossa. It soon develops all the characters of an inflammatory pain, being aggravated by pressure over its seat, which itself may be diagnostic. It has been called McBurney's point, localized at the intersection of a line drawn from the navel to the anterior superior spine of the ilium, with a second, vertically placed, corresponding to the outer edge of the right rectus muscle. Not uncommonly, the pain of appendicitis is diffused, especially about the navel, or even referred to the left iliac fossa, but in every case deep pressure with the index-finger over McBurney's point will show that this is the true center of the inflammation. Further development of inflammatory signs will soon follow. The muscular tissues over the seat of the inflammation become rigid and resistant, particularly along the right rectus muscle, not infrequently giving the sensation of a localized tumor, while the patient lies preferably on his back, with the right leg drawn up. If the inflammation extends the movements of the abdominal muscles on the right side in breathing are plainly checked. A valuable sign at this stage is irritability of the bladder, soon followed by nausea and vomiting.

The pulse also affords valuable signs, for if pus is forming, it rises in frequency, according to the extension of the inflammation. Thus, if the local pain has been allayed by the application of ice, yet the pulse continues to rise and approximate 120 beats, it is a pretty sure sign of abscess formation. The local application of ice is very often sufficient to check this inflammation then and there. Whether or not an abscess is forming, it becomes an anxious question if the symptoms of the illness continue after the third day from the onset. When pus does form, there is no telling in what directions it may burrow.

I had a young man once sent to me from Cleveland, Ohio, on a special train because he was discharging pus from an external opening, which was so offensive in its character that it scented the whole room. I succeeded in deodorizing this discharge, only to find that the pus burrowed its way along the spinal column until the last opening for the evacuation of the pus was made at the nape of the neck. It was more than a year before these purulent collections ceased, but the case ended a year after that by extensive amyloid disease of the liver, kidneys, and other organs, all results of chronic suppuration. In other cases the pus may likewise avoid the peritoneum altogether, and instead, burrowing along the spinal column, perforate the diaphragm and burst into the lungs, of which I have had several cases.

An interesting form of chronic appendicitis is that in which the organ shrivels up into a more or less long cord, very frequently with adhesions formed either to the intestines, particularly the ascending colon, or to various contiguous parts. These cases may give rise to a great variety of annoying abdominal symptoms, whose connection with former appendicitis may not be suspected. One common cause is from kink of the intestine, which may result from the surgical operation for appendicitis.

Treatment.—The non-surgical treatment for appendicitis should be limited to the application of the ice-bag upon the first attack, which in a large number of cases, along with perfect rest, suffices to cure the disease. I have had several patients who have thus recovered from their first attack, and who have remained well for years subsequently. The case is wholly different with recurring attacks. For these now I never fail to recommend a surgical operation, because though they may recover after two or three recurrences, yet we can never be sure but that in one of them perforation and general peritonitis may not happen. That great remedy for inflammatory pain, opium, should not be administered in suspected appendicitis, because by its

relief of the pain it may mask the serious progress of this often seemingly accidental complaint.

MUCOUS COLITIS

It is to be hoped that but few physicians will be called upon to treat a case of membranous colitis at the outset of their career, for if so they will be apt to think that they have made a serious mistake in the choice of their life-calling. The sanguine expectations with which they left college, that success in practice is sure to follow good training and earnest endeavor, are likely to be disappointed in every particular and in the most trying fashion whenever a patient comes with a story of chronic habit of passing long shreds or membranous casts of the bowel.

The experienced clinician has learned to note early in eyes and forehead signs of head trouble, and about the nostrils and the upper lip signs of thoracic derangement, but when the corners of the mouth go down in woebegone expression he knows that inward grief reigns somewhere in the abdomen. But of all physiognomies, a case of membranous colitis wears the most settled aspect of confirmed wretchedness, which the young physician, confident in his resources, meets with assurances of coming relief. But his subsequent experience is apt to be much as follows: For some days his remedies seem to be working well. Then the old pains in the bowels return, now with a sense of general distress pervading the abdominal cavity, best described by the colored woman's term "misery." Then follows a more localized pain, either griping or cutting or sickening, which is explained as due to wind for often various rumblings precede or accompany it. The abdominal parietes frequently become very tender to palpation in places, but no dependence can be placed upon such local signs, for, at the next visit, they are somewhere else, although as bad as ever. Meanwhile the patient develops a decidedly varied train of nervous symptoms. The mind refuses to think or to do anything but feel conscious of distress. Unbearable headaches, neuralgias, and pains here and there, palpitation, sinking spells, and weeping make up the story, until finally the bowels, with exhausting pains empty themselves of quantities of long strings or strands of mucous masses, mixed with the feces or following them, sometimes with a few streaks of blood and rarely with a small amount of pus. Then for a while there is comparative quiet, but sooner or later the old story is repeated, with every accompanying variety of dyspeptic symptoms, referred now to the stomach and now lower down, and each time explained by this or

that offence in diet, by the late bad weather, or something of that character.

In no other complaint is the morbid self-consciousness characteristic of abdominal affections more marked. The patient can neither think nor talk about any other subject than his many woes. Therefore, by reason of the great frequency as well as variety of the accompanying nervous symptoms, many writers have been led to regard the disease as primarily a neurosis, or, at least, to speak of a nervous colitis. I regard this view of its pathology as analogous to that of the philosopher who admired the wisdom of the Creator in causing large rivers to flow past large towns. A colon, the lining of which has fallen into the condition which such a secretion indicates, presents wide tracts of surface for the absorption of all kinds of excrementitious poisons into the blood. It is these poisons which, circulating everywhere where there are nerves, produce all the symptoms referable both to the splanchnic and to the cerebrospinal tracts, which make up the multi-form nervous features of the case, and offer a sufficient explanation of them without needing the intervention of any vague primary nervous lesion.

Moreover, while nervous lesions or irritations do sometimes produce trophic changes, nevertheless no instance can be cited of chronic fluxes from mucous membranes having any such origin. Chronic bronchorrhea and chronic gleet certainly are never primarily neuroses, although asthmatic spasm may complicate the one, or an irritable stricture the other. The truth is, that while in membranous colitis the patient may be reduced to a state of pitiable emotional weakness, the objection to the view that this indicates a nervous etiology is that it leads us in a wholly wrong direction when the subject of treatment comes into consideration. How independent of any antecedents of a neurotic kind this affection may be is illustrated by the following case:

Dr. H. A., a middle-aged physician in active practice, had always enjoyed excellent health until he accepted a staff appointment in the volunteer service during the late Spanish War. While on cavalry duty at a camp in Virginia, which required his being for hours in the saddle, in July, 1898, he began to suffer from an intense irritation referred to the rectum. This measurably subsided for a time, but returned in November and steadily grew worse during the following winter. He then had his sphincter stretched by a rectal specialist, but with no benefit. His symptoms were recurrent attacks of severe tenesmus which tormented him, especially at night, preventing sleep, and which were accompanied by discharges of large quantities of

mucus. He lost 40 pounds in weight and was obliged to give up practice. He came to me for treatment in May, 1899. Examination showed the rectal mucous membrane to be deeply congested, but there were no signs of ulceration. After six weeks of recourse to remedial measures, which will be mentioned later, he was relieved of his urgent symptoms, so that he regained his weight and was enabled to resume practice, but every now and then he has had temporary relapses and has passed complete casts of the bowel of greater or less length. These in turn ceased, but in January, 1900, he reported another return of tenesmus and reappearance of the membranous casts. He has again improved, and I have hopes that, like many other cases, his relapses will grow fewer and at last cease altogether. But what I would note here is, that although he began to develop all the train of nervous symptoms referred to, there can be no doubt that none of them had any primary relationship to his trouble, but were purely secondary. The beginning of the disease was clearly due to a local irritation excited by local causes, acting first on the lower end of the intestinal tract, and gradually extending upward. In like manner, one of the worst cases for nervous complications which I have met was in a young married woman who dated her disorder from prolonged riding in the country on a bicycle.

Now, what does pathologic anatomy reveal as to the nature of this disease? Unfortunately, it must be admitted that autopsies show us rather what this intestinal disorder is not than what it is. Thus, with beginners, it is very natural to surmise that extensive tracts of ulceration will be found in the colon. But generally nothing of the kind is discovered, although the morbid process has continued severely for months and years until the patient succumbs to it. Instead, the colon is found considerably dilated, its walls thin and atrophied, with here and there patches of simple congestion; toward the lower end clumps of small, thin veins, not collected into polypi nor resembling hemorrhoids, are found, and evidently these are the source of the bright red blood which is often mixed with the mucous discharges, but even they do not show that their coats have been opened by an ulcerative process. Microscopic examination of the discharged membranes themselves shows nothing but a structureless material which is albuminous in composition, but containing no fibrin even in the most consistent patches, and in typical samples wholly devoid of pus or leukocytes, or of other ingredients of inflammatory exudates, the cells present evidently being the epithelial cells of the large intestine which have undergone fatty degeneration.

Symptoms.—The clinical symptoms also are quite unlike those of ulcerative colitis, for obstinate constipation, as a rule, both precedes and accompanies membranous colitis, while diarrhea as uniformly accompanies ulcerative colitis.

There are several forms of secondary membranous colitis, on the other hand, which have nothing in common, excepting the formation of membranous patches, with the disease which we are considering, either in their etiologic or in their clinical characters. Thus, in some cases of chronic Bright's disease, the patients lie comatose for days and pass loose movements in bed. After death the colon, as well as parts of the small intestine, are found lined with thick, diphtheric-looking patches, while, because such membranous exudations never appeared in the dejecta, their existence was demonstrated only on the postmortem table. On the other hand, the presence of both albuminuria and of hematuria is not uncommon as temporary symptoms in true membranous colitis. In two patients of mine I have noticed these signs of direct irritation of the kidney repeatedly, but I do not place much store upon them, for other signs of progressive renal disease have remained absent, although these patients have been under my continuous observation for several years. I ascribe these renal symptoms to the entrance of the *Bacillus coli* into the blood through the diseased intestinal wall.

A case of true membranous colitis, such as we have been considering, has no real resemblance to a catarrhal colitis or to a catarrhal inflammation of any kind. What leads to a confusion between this particular affection and others, the seat of which is in the large intestine, is the presence, more or less common to them all, of colonic symptoms. Just as any form of arthritis, whether traumatic, rheumatic, gouty, gonorrheal, pyemic, etc., will cause very similar symptoms of pain on movement of the joints, with redness, swelling, etc., so that the most diverse varieties of arthritis can be confounded in diagnosis and even in nomenclature—witness that impossible hybrid, rheumatic gout—so every serious process in the colon will occasion abdominal distress, tenesmus, or “bearing down,” or pain before and during defecation, etc. It is only, therefore, when we have set these colonic symptoms aside and direct our attention to the conditions which they present, as separately characteristic of each form, that it becomes plain that in true membranous colitis we have a specific affection of the large intestine, the pathology of which is undoubtedly distinct from all other colonic disorders, with, in all probability, as specific an etiology.

From the clinical side some of the etiologic factors appear to be due

to direct mechanical irritation of the rectum, as from horseback or bicycle riding, as already mentioned in two of my cases. Similar to these are cases traceable to pressure on the rectum by uterine fibroids, and it is well to examine carefully in women for the presence of such possible causes. In my opinion, however, by far the commonest cause is the prolonged retention of hardened scybala. A history of preceding habitual constipation of years' standing is the rule in these patients, and, hence, the greater frequency of the complaint in women. It is striking to find, when we carefully investigate the antecedents of most of these female patients, how evidently they have been subject to fecal retention for months at a time, and there is nothing which favors the formation of stationary hard lumps of feces in the weakened and distensible colon as the habitual use of certain laxatives and cathartics. One of the largest masses of the kind which I have ever had to deal with proved on examination to consist mainly of fig-seeds. Once this irritation awakens the morbid process in the colon, it seems to change the nutrition of the intestinal wall in its own special way, with a definite tendency for this initial local change to spread in the wall either upward or downward, according to its first seat, and, finally, to induce a permanent perverted secretion, which becomes very difficult to alter or to cure.

Treatment.—As to treatment, the first indications are to relieve the colonic symptoms proper, as they may be termed, that is, symptoms which are more or less common to all diseases of the colon, as pain and stiffness of the joints on movement are common to all varieties of arthritis. Thus, nothing is so soothing to the tenesmus, the cutting and bearing-down pains, and the general abdominal distress, as free irrigation of the colon with normal saline solution, to which may be added oil of peppermint, 5 drops to the pint. Three to 5 gallons, at a temperature of 100° F., may be employed once in twelve hours, and given by Kemp's rectal irrigator, according to the printed directions which are furnished with this simple and serviceable instrument. The relief which this hot douche affords is often described by the patients as very great, and as enabling them to sleep at night better than any other measure. Care must be taken, however, that all the fluid is returned, lest any quantity retained may afterward provoke a return of pain, thus causing it to act as an enema. By a little practice, however, this may be avoided. Great quantities of mucus are thus dislodged and washed away, but it frequently happens that after the irrigation has been employed the patient subsequently has a painless movement which consists of a large amount of simple mucus without

shreds or membrane. Sometimes I have found benefit from using at the end of the irrigation a gallon of the water in which from 60 to 100 gr. of resorcin have been dissolved, being careful that it is all expelled afterward. Once a week a pint of clean, hot water, with 30 to 40 gr. of silver nitrate, may be used instead of the resorcin. Unfortunately, this irrigation is not curative, as it is in many cases of chronic catarrhal or chronic ulcerative colitis, for, although it serves the valuable service of eliminating the complication of direct colonic irritation which so often undermines the patient's health, and, by so much, aggravates the local processes of the disease, yet it does not deal with the nutritive change itself in the intestinal wall, but only some of its effects. Nevertheless, it should not be omitted from the system of measures which should be adopted for the more or less prolonged methods of treatment needful in every essentially chronic disease.

The question arises, Have we any medicinal remedies which can be expected to be of service in changing the disordered nutrition of the intestinal mucous membrane? I believe that we have one such remedy, and that is, small, and what I may call alterative, doses of castor oil. I have had patients report that the relief afforded by this medicine has been most unmistakable from its first administration. I prescribe it in an emulsion, of which each tablespoonful contains from $\frac{1}{2}$ to 1 dram of the oil, preferably $\frac{1}{2}$ dram at first, to be taken either half an hour before meals or an hour after meals. This should be continued for months together, and only intermitted when it seems unmistakably to increase the patient's dyspeptic symptoms.

The nitrate of silver in $\frac{1}{4}$ -gr. doses, combined in pill or capsule form with 9 gr. of turpentine resin, and taken three times a day, is sometimes of much service, although not as uniformly as in chronic catarrhal or ulcerative colitis, in which complaints $\frac{1}{4}$ gr. of opium is added. To enable the turpentine to dissolve and not pass the bowels unchanged it should be pulverized well with licorice powder and a drop or so of liquor potassæ added to each capsule. After the silver has been taken for six weeks, the sulphate of copper in $\frac{1}{4}$ -gr. doses can be substituted for it.

Meantime, membranous colitis is a complaint particularly characterized by general disturbance of the digestive functions of the whole alimentary tract. This is a result, and not, as many deem it, a cause of the colitis; but there can be no doubt that the consequent maldigestion and fermentation of the ingesta become of themselves a complication of the original complaint. The stomach is apt to be dilated and the small intestine the seat of disturbed innervation and a perverted

secretion. Five grains of resorcin in solution with tincture nucis vomicæ, half an hour after meals, constitutes a good prescription for the gastric symptoms, to be supplemented by 10 gr. of sodium benzoate and 10 gr. of bismuth salicylate in capsules, an hour after each meal, as intestinal antiseptics. We should, however, from the first bear in mind the probable dependence of the disease itself on chronic constipation, and against this I would limit myself to the employment of salines exclusively. From 1 to 2 drams of phosphate of soda with 10 gr. of salicylate of soda should be given every morning in a tumblerful of water as hot as the patient can sip it. After a time the same quantities of sulphate of magnesium may be substituted. Daily massage of the bowels, particularly of the tract of the colon, is also to be highly recommended. We need not fear arousing any inflammatory process by such manipulation, for we are not dealing with inflammatory disease. Once in a while, however, we do find a region which always remains tender to palpation, and in such cases a local blister often is beneficial.

The diet of such patients is important to consider, if only from the fact that many of them most unwarrantably reduce it from fear of this or that article disagreeing with them, according to their remembrance of some severe attack after they partook of it, until they finally live on only some very few and insufficient forms of food. We may simply exclude beans, corn, spinach, and the woody vegetables, along with oatmeal among the cereals, and then encourage the patients to eat meat, poultry, eggs, zoölak or koumiss, peptonized milk, and most cereals, with instructions not to care what will happen. In some cases pancreatic emulsion is of marked service.

Finally, bodily movement and out-of-door exercise is beneficial on general principles. Repeatedly we find a summer change to the country does more good than anything else, for fresh air is the best remedy for constipation that can be named, and its effect is not lost in disease.

Recent writers, notably Hale White, have recommended, whenever everything else fails, to give the colon a prolonged rest by the establishment of an artificial anus in the right flank. Some recoveries have been reported from this procedure, and I see no reason why, in otherwise hopeless cases, it should not be tried.

Dr. R. F. Weir, of New York, has suggested a mode of treatment which is often curative, and that is to cut down upon the appendix vermiformis and attach it to the abdominal wall. Then he opens the tip of the appendix and proceeds to wash out the colon through

this artificial opening, using simple saline, to which I would add peppermint as the agent for this kind of lavage. By thus daily cleansing the whole colonic tube he has succeeded in arresting the complaint altogether.

BACILLARY DYSENTERY

It is as incorrect to term dysentery a colitis as to call an eruption of small-pox a dermatitis, because the chief forms of dysentery are due to an actual infection by two wholly distinct agents, the first a bacillus, and the second a different agent because it is of animal origin, namely, the *Amœba dysenterica*.

Although dysentery has been known from ancient times, it was not until the latter part of the 19th century that its being due to specific infections was demonstrated.

Dysentery is one of the oldest of known affections, as it is described by Hippocrates and in Eber's Egyptian Papyrus 1750 years before him. In all ages it has been the scourge of armies, while it also occurs as a local epidemic in jails and prisons. It always has present the same characteristic of attacking the lower bowel, but it was not until lately that it was divided into bacillary and amebic dysentery. The discovery of the *Bacillus dysenterica* we owe to the Japanese bacteriologist Shiga in 1898, who showed that this bacillus prevails all over the world. It is a short plump rod, non-motile, and bears some resemblance to the *Bacillus coli*. Different strains of it, however, have been demonstrated by their different reactions on culture-media or by their different effects upon various sugars.

There is no doubt that this bacillus, besides being the specific cause of this form of dysentery, is communicated from one person to another equally like Asiatic cholera by drinking water or by food taken to the mouth when contaminated by the presence of the bacilli. It can infect a stream of water and thus spread the disease from one town to another. It has even the other characters of such diseases, that it may be disseminated by persons who are actually not sick with it; in other words, by true dysentery carriers. This has been demonstrated in the case of infants who are not themselves sick with the complaint, but whose stools show the presence of the bacillus. There is no doubt that the stools of dysentery patients are at all times dangerous, such as when the napkins are soiled by the discharges, or it may be disseminated by dust and not at all unlikely by flies. This explains both widespread infections in camps, and also local prevalence in prisons or other institutions where individuals are crowded together.

Symptoms.—In severe cases the onset may be sudden and the course rapid, so that death occurs in about forty-eight hours. Pain is first felt in the bowels, leading to straining and tenesmus, with frequent passages of blood, mucus, and in prolonged cases an admixture of pus. The tenesmus becomes very distressing, often leading to ineffectual attempts at defecation and, in children, to prolapse of the anus. The stomach is not so often affected as in diarrhea, but fever sets in early, with a temperature of from 102° to 105° F. and with a small, quickened pulse. The tongue at first is coated white, but afterward is shrunk, red, and pointed. In chronic cases, which may last from three to six weeks, the passages may not be so frequent, but they always have the same dysenteric character, with the presence of mucus, blood, and often pus. This latter ingredient is a pretty sure sign of ulceration having already set in somewhere in the rectum. There is always a special tendency to excessive peristalsis of the whole intestinal tract. Death occurs from pure exhaustion, accompanied in chronic cases by much emaciation.

When death has happened in acute cases we find the whole mucosa of the large bowel swollen and covered with an exudation which may be brushed off the surface of the membrane, but even then distinct patches of necrosis may be evident, which, if the case is at all prolonged, become the sites of ulcers. These, however, do not have the ragged and excavated edges which are characteristic of the ulcers of amebic dysentery. In other words, they are not apt to involve the muscular or serous coats. It should be stated that there are cases in which the upper part of the colon is involved, with extension through the cecum to the ileum. These patients do not show the same tenesmus or discharge of mucus and blood characteristic of the infection when it involves the rectum. On the other hand, plain toxic symptoms from a general absorption of poisonous materials into the circulation are unmistakably present.

Treatment.—The first indication for treatment is to enjoin absolute rest in bed until the symptoms of the disease have disappeared. It is hardly to be expected that any person will get well if he continues to walk, as is shown by many cases leaving their beds after a decline, but not actual cessation, of the discharges.

As in other severe and acute diseases, no one form of treatment should be expected to be uniformly successful. My own experience for a number of years leads me to prefer for the dysentery of our country the plan by which the bowel is first evacuated with an ounce of castor oil. This will operate usually in three hours, and when it

has cleared the bowels an enema of 20 drops of laudanum in 3 oz. of plain water, with the addition of 20 gr. of potassium bromid, should be given. The bromid is given for the purpose of allaying at once the tendency to reflex peristalsis. After this an emulsion of 1 oz. of castor oil in 6 oz. of mucilage of gum arabic should be made, with $\frac{1}{2}$ to 1 dram of laudanum. The dose of this emulsion should be a tablespoonful every two or three hours. This treatment I have found very efficacious both in acute and chronic dysentery. In one case of discharge of blood for two years it promptly relieved the patient.

Another method of treatment particularly recommended by French physicians is the employment of saline purgatives, notably the sulphate of soda. It is first given in doses of $\frac{1}{2}$ to 1 oz. of the salt dissolved in water in the morning, which will act usually in about three hours. After this it is to be given in $\frac{1}{2}$ -oz. doses four times daily. Major Buchanan recommends 1 dram of sodium sulphate in 1 oz. of fennel or peppermint-water four, six, or eight times a day, until every trace of blood and mucus has disappeared. This treatment is adapted for acute cases only.

AMEBIC DYSENTERY

Wholly distinct in nature and cause from bacillary dysentery is that caused by amebæ or animal parasites. This is particularly the case in tropical dysentery, but, though uncommon in Great Britain, it is very frequent in the United States, if not actually endemic in the Southern States of the Union. Osler states that in 1908, 123 out of 182 cases of amebic dysentery came from the vicinity of Baltimore.

It is not uncommon in children, but the greatest number of cases occurs between the ages of twenty and thirty-five, much the larger portion being males. In the United States the whites are much more susceptible than the blacks.

This ameba was first identified by Lanblain (1859), and subsequently by numerous other investigators. It is from 15 to 20 mm. in diameter, has a clear outer zone (ectosarc), and contains a nucleus and one or two vacuoles. They may be found in the discharges, and also by removal from the intestinal wall by a catheter, in enormous numbers. These amebæ are very resistant to everything except contact with ipecacuanha. They can withstand drying from eleven to fifteen months.

The amebæ begin their work by passing through the submucosa, and here they accumulate at first in discrete masses, but then burrow under the mucosa before they cause its necrosis. This makes

the ulcer different from the more superficial one of bacillary dysentery, the amebic ulcer presenting ragged edges with excavation underneath the sites, in some cases forming along sinuous passages.

Amebic dysentery may present a mild aspect, the patient scarcely knowing that he has any bowel trouble. On the other hand, most cases present acute symptoms from the beginning, with pain, tenesmus, and frequent bloody discharges. A patient's strength and nutrition rapidly fail, the heart becomes feeble, and death may occur in less than a week.

In former years I greatly dreaded amebic dysentery, because it seemed certain to become chronic and incurable.

In addition to invading the intestine, it has a special tendency to produce abscesses in the liver, which may be single or multiple. Less commonly they are on the lower or concave side of the liver, and, as usual with actively forming pus, they may work out their tracks in all directions, breaking into the ascending cava, the peritoneum, or even the pericardium, as well as into the intestine, occasionally discharging on the outer surface of the body. Single abscesses may be of considerable size and are usually in the right lobe of the liver. Most commonly they are on its convex surface, which explains their tendency to break into the lungs. The amebæ may be found in great numbers in the fluid, but more particularly in the walls of the abscess. The multiple abscesses are usually small and superficial, but may be extremely numerous and scattered throughout the organ. On examination they all contain the amebæ.

This metastatic abscess formation, so to speak, in the liver does not occur in bacillary dysentery. Considering that many cases of amebic abscess of the liver are quite latent in their course, a physician should be on the watch for certain symptoms. The first of these is enlargement of the liver, whether upward or downward, and not uncommonly this organ becomes tender to palpation. But one of the most trustworthy signs is increased leukocytosis, which may be as high as 50,000, the average being 18,000; but where abscess is not present the average would be 10,600. In rapidly forming abscesses there may be chills, fever, and sweating. When the abscess has burst into the lung, a reddish expectoration occurs in which amebæ are found. The ulceration of the intestine may affect the whole or some parts only of the colon, but is found particularly about the cecum, the hepatic and the sigmoid flexures, and the rectum.

Different from the bacillary dysentery, there is a serious tendency in the amebic form to perforation of the bowel. Of 100 autopsies

in Manila, perforation of the colon took place in 19. The sloughing of the mucosa may in some cases be *en masse*, so that the consequent healing may cause actual stricture of the bowel.

Amebic infection may be present for weeks without the patient knowing it, the first sign of its existence being the formation of liver abscess. It is a curious fact that aside from the hepatic abscesses the ulceration in the intestine is not often accompanied by formation of pus. There is also a remarkable variety in the symptoms of the complaint, which may be so mild as to consist only of slight abdominal pain with occasional diarrhea. But there is an acute form in which the onset is sudden, with much pain and tenesmus, the stools being both bloody and mixed with passages of mucus. In some, large sloughs are passed, the patient becoming rapidly emaciated, with toxic weakness of the heart, death occurring within a week. If the symptoms become chronic, the emaciation which follows is more extreme than in any other infection. It is notable, however, that these serious changes of general nutrition occur chiefly in the tropics. In the United States the patients rarely, if ever, show much loss of flesh, but only symptoms of alternating constipation and diarrhea, which may go on for a year or more, showing intervals of apparent improvement, followed by relapses after the slightest indiscretions of diet.

Treatment.—We know that now we have an almost absolute specific against amebic dysentery in powdered ipecacuanha. Years ago Dr. O'Shaughnessy published his statistics on the treatment of dysentery in India by large doses of ipecacuanha. At that time the distinction between bacillary and amebic dysentery was unknown, and I have little doubt that the dysentery which he reported was of the amebic form. Recent authors also recommend massive doses of ipecacuanha in the treatment of bacillary dysentery, but I have my doubts whether this drug is as effective in bacillary as it certainly is in that due to amebæ.

RECTAL ULCERS

Ulcers in the rectum, however produced, are slow to heal. This might be naturally inferred from the fact that the parts cannot long rest, and besides are periodically smeared over by fecal matter. I think that I have expedited the healing process in many cases by ordering that the rectum should be washed out after every passage with $\frac{1}{2}$ to 1 pint of water, to which a teaspoonful of chlorate of potash and 5 drops of oil of peppermint have been added.

HEMORRHOIDS

Hemorrhoids are, primarily, enlargements of the hemorrhoidal veins. As these veins are the lowest vessels of the portal system, it may be readily seen that prolonged congestion of the liver, occurring especially in sedentary persons with tendency to constipation, may favor their formation. The only curative treatment of hemorrhoids is by a prolonged course of mineral waters. Thousands of patients go every year to Kissengen, because the Kissengen Springs are almost exactly of the same composition as the serum of the blood minus its corpuscular and albuminous ingredients. They, therefore, simply afford an excess of fluids natural to the system, which excess can be got rid of with the least possible drain upon the fluids and tissues of the body. After several weeks' course of these waters, taken in the morning, the patients hope that they will have an attack of inflamed hemorrhoids, for that will be the last disturbance from the piles perhaps for years. This treatment also answers the same purpose with bleeding piles. When, on the other hand, the hemorrhoids inflame, local treatment by suppositories is the best, of which the kind sold under the name of Anusol I have found to be the most efficacious. In acute cases, when the hemorrhoids protrude they may be treated by douches of hot water, ending with the sudden application of ice-water.

CHAPTER VII

DISEASES OF THE LIVER

THE liver is both the largest and heaviest organ in the body. Structurally no contrast could be greater than between liver and kidney substance. The kidney is made up of a great variety of tubes, lined with cells which differ from one another in their function as well as in their position. The liver cell is always the same throughout the whole organ. Therefore, the kidney presents us with many as yet insoluble problems; the liver is in no way behindhand in this respect, for, notwithstanding the uniformity of its makeup, it performs a variety of functions, only a few of which are yet understood.

HEPATITIS

Hepatitis, or inflammation of the substance of the liver, is by no means uncommon as a result of chronic malarial infection, particularly if the patients are alcoholic in their habits. The symptoms vary according to whether the inflammation has extended to the surface of the organ, in which case a cough may develop, which is in no sense an expectorant cough, but is hacking instead. This cough is due to irritation of the branches of the phrenic nerve widely distributed on the under surface of the diaphragm. Besides a sense of weight and dull aching pain in the liver itself, the irritation of the phrenic nerve may cause pain between the shoulder-blades or at the top of the right shoulder, as we have mentioned in speaking of inflammation of the liver from gall-stones.

The **treatment** should be according to its cause, and, in general, would be the same as in hepatitis following gall-stones.

CHRONIC CAPSULITIS (PERIHEPATITIS)

There is a form of perihepatitis which is very chronic, and produces enormous thickening of the capsule of the liver with consequent shrinking of the organ. Postmortem, a shrunken liver tissue is not found to be cirrhotic, but simply compressed by the capsule. This disease does not occasion ascites, and is so destitute of symptoms that its presence is only revealed at autopsies.

JAUNDICE

We begin with the easiest recognized derangement of the liver—jaundice. In this affection all the tissues, with the significant exception of nervous matter, become tinged with the coloring-matter of the bile. This, however, should be noted by daylight and not by artificial light. However produced, its clinical accompaniments are much the same.

The earliest manifestation of jaundice is a tinting of the conjunctiva. When, however, the jaundice is prolonged, and the obstruction more or less permanent, the color changes from lemon yellow, in simple jaundice, to a deep olive green or a greenish black. In the chronic forms intense itching of the skin takes place, but then itching sometimes precedes the jaundice itself. The jaundiced skin very often shows localized eruptions, such as urticaria and boils, and patches of a red color will appear from dilatation of the capillaries.

The secretions become colored also with bile-pigment, so that the sweat tinges the linen. The saliva and milk, however, are rarely stained. When pneumonia coexists with jaundice the expectoration may also be tinted. The urine becomes very early affected, changing sometimes into a deep black green. In long-standing cases the kidneys also become irritated, and show some albumin and bile-stained tube-casts. Other characteristics of obstructive jaundice are that no bile passes into the intestine. The stools, therefore, are gray-drab or slate-gray color, and are usually fetid and pasty. This gray color is in part due to the presence of undigested fat, the bile having the property of digesting the fats. The pulse also becomes slow, and may fall to 40, or even below 30, a minute. This occurs generally only at the early stage of jaundice. Along with the fall in the frequency of the pulse the breathing is sometimes very slow, falling to 10 or even to 7 a minute. Jaundice always causes a tendency to hemorrhage, and on that account surgeons are careful in operating on jaundiced patients, for a hemorrhage may be very difficult to control. It is customary, therefore, for surgeons, previous to operating on such cases, to give free doses of the chlorid of calcium, 15 to 20 gr., though the lactate of calcium is more easily borne. As we should expect, purpura frequently complicates jaundice, and in these cases I have often had much trouble with the supervention of hematuria. The most serious of the symptoms of protracted jaundice are those connected with the brain. These often begin with marked depression of spirits, and then may suddenly develop convulsions, to be followed by fatal coma. The

terminal symptoms may closely resemble those of uremia, but the nervous system is not often implicated in jaundice until it has persisted for a long time.

Jaundice is not a disease, but a symptom, arising, as we shall see, from many different causes. The simplest form is a catarrhal jaundice, beginning with inflammation of the duodenum, which extends up the bile-passages, and in many cases is conjoined with inflammations of the head of the pancreas, which is traversed by the common duct of the liver. This form of jaundice occurs without either pain or fever, but nearly always accompanied with some gastric symptoms; the patient, indeed, may not feel much out of sorts, and comes for advice only on account of the discoloration of the skin. He should be warned, however, to keep to his room, for we are never certain but that other more serious conditions may develop.

Causes.—We may divide the cases of jaundice, according to their causation, into the following classes—first, cases of obstructive jaundice, of which jaundice caused by gall-stones impacted in the common duct are the most usual. We shall, however, treat of these cases in our section on Cholelithiasis. Due to the very low pressure with which bile is secreted by the liver cells, so that, in fact, it resembles a simple leakage instead of a secretion, some cases of jaundice arise from very slight obstruction, such as duodenal catarrh, to which we have already alluded. There are cases of jaundice, however, in which the mechanism of obstruction is obscure; such are the cases of icterus neonatorum, occurring in newborn infants and soon disappearing. Sometimes jaundice becomes pronounced from purely mental causes, as in my practice in the case of a gentleman who had suffered severe financial losses.

Jaundice sometimes supervenes in the course of a specific infection like pneumonia or typhoid fever. Quite different from any of the causes mentioned is jaundice due to the pressure of tumors on the bile-duct. This often occurs where cancer invades the liver.

That jaundice may be produced by blood-poison has long been known. One of the most marked and prolonged cases in my experience occurred in a Frenchman who had been bitten by a cobra. I have known of exactly similar jaundice being caused by accidental swallowing of a poisonous dose of colchicum. Moreover, epidemics of infectious jaundice have been reported in various parts of the world, including the United States. These attacks of epidemic jaundice go by the name of Weil's disease, as he first described them in 1886, the nature and origin of which infection is quite unknown.

Treatment.—The treatment of these cases should be to keep the bowels acted upon by saline aperients, one of the best of which is to take one-half a tumblerful of Pluto water, with the same amount of hot water, on rising, and then a powder, with 15 gr. of sodium salicylate and 10 gr. of the sodium benzoate, an hour after meals and at night. Occasionally, say once or twice a week, a mercurial laxative may be taken at night of 3 to 5 gr. of calomel, with 30 gr. of compound jalap powder. If the case proves obstinate high enemata of hot normal saline may be used night and morning.

CHOLELITHIASIS, CHOLECYSTITIS, AND STENOSIS

Gall-stones are not stones at all, for they float in water and are composed chiefly of albuminous materials. It is a curious illustration how names fetter mental conceptions that many persons, including most surgeons, conceive of these things as minerals, and unfortunately too often act accordingly. The great difference of gall-stones from resembling anything mineral is brought out when we learn how they are formed, for we then find that there is no resemblance between a urinary calculus, which is unmistakably a stone, and these cheese-like substances, which are misnamed gall-stones. So in their clinical accompaniments the contrasts are no less striking. According to Kehr, gall-stones occasion no symptoms in 95 per cent. of all cases in which they occur. In one of my patients there were 76 gall-stones in a single bladder, which had lain there for no one knows how long, until their presence was discovered at operation, but if, instead of 76, only one calculus is present in the urinary bladder the patient can scarcely pass an hour without feeling it.

Etiology.—As to the etiology of gall-stones, we have learned much of late years from researches of Prof. Naunyn. First, in contrast with urinary calculi, general constitutional conditions have little to do with the tendency to their formation. Nothing like a uric-acid diathesis or derangements like those which cause oxaluria or phosphatic deposits precede the formation of gall-stones. Instead, they arise wholly from local causes and changes in the biliary passages themselves affecting the bile after it is secreted.

The bile itself is a secretion about equal in daily amount to the urine; that is, from 2 to 3 pints, but of such low specific gravity that it contains only from 1 to 2 per cent. of solids. It is secreted by the liver cells under such low pressure that it almost resembles a simple leakage, so that the slight obstruction caused by catarrhal swelling of the mucous membrane of the biliary passages may suffice to cause jaundice.

During active digestion it flows uninterruptedly along the hepatic bile-ducts directly into the intestines, and not into the gall-bladder, this flow being much aided by contraction of the diaphragm in active breathing. In the intervals of digestion, and particularly during the repose of sleep, the biliary outlet is closed by the sphincter-like contraction of the muscular wall of the duodenum, and the bile then flows into the gall-bladder instead. In proportion, therefore, to the slow digestion and to the sedentary habits of many persons the bile accumulates in the gall-bladder and becomes there more concentrated, but, however concentrated it may be, there is no danger of a formation of a gall-stone so long as the normal constituents of bile are held in solution, as they are by the presence of bile-salts, especially the glycocholate of sodium. Small dark precipitates of calcium and of bilirubin, derived from the coloring-matter of the bile, are readily formed, but would be of little account were it not for the precipitation of layers of cholesterin about them, which ultimately form the major proportion of gall-stones. Cholesterin is found in abundance wherever degeneration of cells is going on. It is, therefore, present in every catarrhal discharge of a mucous membrane, as in the sputum of bronchitis and of phthisis, or wherever there is pus. So soon as the catarrhal condition of the gall-bladder sets in the cholesterin may be seen in discrete drops in the degenerated epithelial cells of the mucous membrane, which set it free to adhere to other similar drops, leading to the important deduction that the components of gall-stones are not derived from the liver itself, but are generated by a local derangement of the mucous membrane of the biliary passages and of the gall-bladder.

Our progress in the pathology of cholelithiasis, however, shows that gall-stones are direct results of infection. Everything else must be contributory, but it is the entrance into the biliary passages of micro-organisms which is the efficient cause, as it is due to them that catarrh of the mucous membranes is set up. Much the most common of these bacterial invaders, as we might expect, is the *Bacillus coli communis*. In some cases clumps of these bacilli seem to be themselves the nuclei of gall-stones, as Prof. Welch has obtained living colon bacilli from the center of gall-stones. Infection by the *Bacillus coli*, common in other disorders, is very often accompanied by chills or even severe rigors, and this explains the frequent coincidence of chills in attacks of biliary colic.

Another bacterium has also been proved to initiate cholelithiasis by its entrance into the gall-bladder, and that is the typhoid bacillus. As far back as 1829, Lewis drew attention to the frequency with which

the gall-bladder was affected in typhoid fever. Thus, Pratt in 30 autopsies found the typhoid bacillus in the gall-bladder in 21, and Chiari in 19 out of 21. It is also extraordinary how long the typhoid bacilli may remain in the bladder after the fever has ceased and set up cholecystitis or an attack of gall-stones. Thus, Pratt reports a case in which the typhoid bacillus was isolated from the bile in the gall-bladder seven years after the fever, and Dongern reports a case fourteen years after. Biliary calculi have also been experimentally produced in the gall-bladders of animals by the injection of typhoid bacilli.

Diagnosis.—The diagnosis in the case of cholelithiasis may be either easy or one of the most difficult to make out of any of the disorders in the abdomen, which is saying a good deal. Moreover, different from a stone in the urinary bladder, it is not enough to make the diagnosis of a calculus, but we must be further able to form an opinion as to what else occurs as the result of the local trouble. Ordinarily, we can wait till we see fit with a urinary calculus without immediate danger to life, but with a biliary calculus we may soon find ourselves under as much responsibility as in case of appendicitis. Thus, a man was admitted to my hospital service from whom it was difficult for me to obtain any satisfactory account of the beginning of his illness, because he was delirious and had a low fever simulating typhoid. He was but little jaundiced, but an indistinct swelling could be made out in the region of the gall-bladder. His blood count showed a decided hyperleukocytosis, whereupon I had him transferred to my colleague, Dr. Brewer, for immediate operation. While struggling as he was going under the ether his gall-bladder burst through a gangrenous patch in its wall, but, being where he was, he was speedily relieved from danger and made an uninterrupted recovery.

Hence, as in his case, one result of cholelithiasis may be general septicemia with ulceration of the gall-bladder, permitting the escape of the calculi into adjoining parts, causing either a rapid, fatal general peritonitis or abscess of the liver, or extensive adhesions of the gall-bladder to the liver and intestines, until the symptoms due to these complications may wholly obscure the original ones first caused by the gall-stones. With the majority, however, there are histories of preceding attacks of biliary colic, as well as other prodromal symptoms, important to note as elements for early diagnosis.

Symptoms.—Thus, as regards the attacks, pain is the earliest symptom, and, as always, pain is a symptom which repays study more than any other. In all typical cases of gall-stones the pain is very sudden. No other pain is so sudden in its onset or so quickly severe; in fact, it

may kill outright, as occurred in the case of an acquaintance of mine. This is not an inflammatory pain, but is of the same nature as the colic produced by a calculus impacted in the ureter, which certainly is not due to either inflammation of the ureter or kidney, because it has all the characters of stretching pains, which are different from those of either inflammatory pains, pressure pains, or neuralgic pains, as we have already seen in our chapter on Pain.

Pains caused by parts being put on a sudden stretch, as by calculi while passing through ducts or by severe sprains, always produce immediate faintness and nausea, which other forms of pain do not. In an inflammatory pain the patient keeps his hands at a respectful distance from the affected part, whereas in the case of a sudden onset of hepatic colic the patient grabs his side as forcibly as he does with lead-colic or a limb with the lightning neuralgia of tabes. The site of the pain is always most important to make out, and here, as in all pains, particular attention is to be paid to the gesture of the patient. When asked to show where his pain is he is unable to describe it well, and, if severe, he may say it is all over, but, if asked to show where he first felt it, his fingers tell his story better than his words.

If the pain is due to a calculus in the cystic duct its site is to the right of the rectus muscle, just below the free border of the ninth rib. If the calculus has passed further on into the common duct, a painful point on pressure is found from $1\frac{1}{4}$ to 2 inches at the right of the umbilicus. Not only do nausea and belching of wind come on during the pain, but also vomiting, and sweat breaks out on the forehead, a characteristic of all severe stretching pains. Besides its primary site, the radiations of this pain are characteristic, the patient's hand passes to the right, horizontally around to the back, and then up between the shoulder-blades, and sometimes he complains of pain on the top of the right shoulder, but rarely at the beginning of his attack. This contrasts with the pain of lead-colic, in which the patient works his hand around the umbilicus, but does not pass it to the back, or to the pain of renal colic, in which the hand goes at once to the back and then quickly down the side and to the front, down to the groin, using the border of the hand to describe the downward course of the pain and not the fingers, as he does in hepatic colic. As long as these paroxysmal pains continue to occur they mean an impacted calculus, and the occurrence of a chill with them is another diagnostic sign of gall-stones as the cause of pain.

It is when a change occurs in the character of the pain to a distinctly inflammatory type that we have cause for apprehension, and that is

when local tenderness to pressure commences and its area progressively increases along with increasing rigidity of the overlying muscles.

The pains of gastric ulcer and, still more, of duodenal ulcer occasionally seem like those in gall-stones, but careful local examination will show tenderness on palpation, with rigidity in the epigastrium rather than in the region of the gall-bladder, and there is also a distinct local throbbing or pulsation which is not present in hepatic colic. The time of the pain commonly differs, for the gastric pain rarely comes on in the night, as hepatic colic often does, and the gastric pain usually has some relation to a habitual interval after taking food. The pain of gastric ulcer also is felt more toward the left of the median line, while that of gall-stones passes to the right.

Occasionally displacement of the right kidney occurs in women with relaxed abdominal walls, causing sudden pain, faintness, and stomach disorders, which may be mistaken for an attack of gall-stones, especially as a tumor may then be felt in the neighborhood of the gall-bladder. Percussion over the swelling will be dull if the swelling is due to a distended gall-bladder, because that would be in front of the colon, while percussion would be resonant if due to a displaced kidney, because the kidney lies behind the colon. Moreover, the kidney may be pushed upward and backward, but a distended gall-bladder cannot. With the restoration of the prolapsed kidney the pain soon ceases.

On the other hand, some cases of gastralgia are quite difficult to distinguish from biliary colic, and give rise to more uncertainty in diagnosis than any other pains. They have, in common with hepatic colic, suddenness and severity of onset and often vomiting and nausea as well. In one case of a medical friend of mine I diagnosed the attacks as malaria. They were extremely severe, but, as they were distinctly periodic, I prescribed dram doses of the fluidextract of ergot, which promptly relieved him after quinin had wholly failed. In another instance, a physician consulted me for severe attacks of pain in the hepatic region, coming on about 5 P. M. and lasting through the night, with great prostration and vomiting, his pulse dropping down from 60 to 40. These pains recurred every other night for some three weeks, and he then consulted me, whereupon I recommended that he have his blood examined. The report showed the presence of *Plasmodium malariae* in abundance. As before mentioned, I prescribed ergot, and at first it arrested his tertian nocturnal pains completely, but afterward they recurred, whereupon I prescribed paregoric with quinin. (See article on Treatment of Malaria, Estivo-autumnal Variety, with

Camphorated Tincture of Opium.) He then passed another interval of a week without any pain, but at the end of that time he had a severe attack with paroxysmal pains and a temperature of 102° F., accompanied with white scybalous passages. These pains I diagnosed as due to gall-stones, and put him on my treatment for the same, after which he soon recovered. Here we seem to have had both malarial and gastral-gic and gall-stone colic in succession, the clinical distinction between them being a definite periodic tendency in the former and not in the latter.

The gastric crises of tabes may resemble biliary colic in the pain and the accompanying vomiting, and, as sometimes they precede all other developments of tabes, their nature may not be suspected. The persistent vomiting, but especially the total absence of tenderness on pressure in spite of the continuance of gastric symptoms, should lead to examination for other signs of tabes which usually are readily found.

The sequence of events which ends in a calculus leaving its resting place in the gall-bladder and becoming impacted in the bile-duct, with consequent pain, is first an irritable sensitiveness of the walls of the gall-bladder, induced by catarrh. While in this state a fresh influx of bile, regurgitating from the common bile-duct, distends it so as to produce expulsive contractions, which dislodge a calculus first into the neck of the gall-bladder and then on into the cystic duct, where it may stick or else be further pushed on by peristaltic action into the common duct. This may account for the greater frequency of the first attacks of biliary colic occurring at night, when the flow of bile is the greatest into the gall-bladder, as above mentioned. When we remember that the cystic duct is so narrow that normally only a hog's bristle can pass through it, this fact readily accounts for the agonizing pain caused by the stretching of the duct by the calculus.

There is a common impression that, when a calculus plugs the outlet of the gall-bladder this viscus may soon become distended and form a tumor which may be felt, but the facts are that in the common duct obstruction the reverse usually happens. Thus, Courvoisier found the gall-bladder contracted in 53 cases of common bile-duct obstruction and distended in only 17. We should remember that the gall-bladder is both filled and emptied like a bottle, through one neck. That neck ends in a short tube, which is soon joined by another tube, the hepatic duct, which conducts all the bile which is secreted. Plug the first tube or the cystic duct and nothing can get either in or out that way; plug the second, or hepatic duct, and no bile can then pass back into the bladder, though the bladder may still be able to empty

what has passed the obstruction in the common duct. With the first or the cystic duct closed, the gall-bladder may fill up and become greatly distended, but ordinarily not with bile. A watery fluid instead is secreted from its walls, much as if it were a closed cyst, and, on drawing this off, it is often found to contain but little mixture of biliary ingredients. So long as it remains uninfected it is striking how little pain or disturbance this tumor causes, though it may grow to a great size and reach the pelvis and even across the median line to the left. That it is a distended gall-bladder may be inferred by the important rule in abdominal tumors, that they spring from the region where no free border can be felt. In this case no free border can be felt above, for it seems to be continuous with the liver, and, unless bound by adhesions, descends plainly with inspiration. The lower portion is often easily movable, and usually gives a sensation of being smooth and rounded and of containing fluid. On the other hand, a gall-bladder tumor which is painful and sensitive to manipulation means that there is cholecystitis present, and all its other accompaniments must then be carefully investigated.

Stenosis of the Bile-ducts.—Stenosis of the bile-ducts is not a separate affection, but the result of external pressure from tumors or from chronic inflammation caused by gall-stones.

While nearly every case of a fully formed stone in the urinary bladder calls for surgical interference to get rid of it, in my own experience only 1 out of 43 of those who suffer from gall-stones would ever need to undergo an operation. This fact should be emphasized, because the judgment of surgeons on this subject is of little value. Thus, to cite my own experience on this question, I have full notes of 56 cases in which I was able to follow the patients' subsequent history. It must be further stated, that many of them were not only chronic but very severe cases. Thus, one patient, a man, had violent attacks covering a period of over four years. Another, a woman, was repeatedly jaundiced for five years, with a tendency also to subcutaneous hemorrhage. Another, a woman, became greatly emaciated from recurring attacks, accompanied with jaundice, for five years, in one of which she was confined to bed for two months with grave symptoms of septicemia. One patient, an elderly lady, had become greatly reduced in flesh by attacks extending over four years, but after two months' treatment, in 1895, she has remained well ever since. Another patient, a man, began his attacks in 1890, first about every three months, and then, as the intervals were growing shorter, until they occurred every three weeks, accompanied with persistent jaundice

and great emaciation. When I saw him in March, 1894, he could find no relief except by hypodermics of morphin. He soon began to improve after the treatment I recommended, which he kept up for three months, and his physician reported, in January, 1902, that he had remained well ever since.

In none of these severe cases was the relief immediate, so that it could be ascribed to the passage at one time of a single calculus with consequent cessation of symptoms. The gradual and not sudden recovery, with recurring but progressively milder attacks, until final relief occurs, is a suggestive clinical fact. As gall-stones do not come from the liver, nor are they ever composed of gall or bile, my own experience leads me to be certain that the best solvent is a free flow of limpid bile into the bladder and out again. We can readily see, however, that it may require a free flow for a number of weeks to do so, as it would have first to check the catarrhal process in the walls of the biliary passages while it also was acting on the concretions themselves.

Treatment.—The first indication in the treatment of cholelithiasis is to prevent bacterial invasion from the intestines. The commonest condition which favors this infection is the unhealthy state of the intestinal walls, induced by chronic constipation, for it is noteworthy how commonly these patients admit that they have always been constipated and have had to use laxatives for years to have their bowels move at all. This condition also naturally explains the special proclivity of women to this complaint. For this purpose, my usual prescription is phosphate of soda, 2 oz.; salicylate of soda, 3 drams; and benzoate of lithia, 1 dram, divided into 12 powders, 1 powder to be taken in a tumblerful of hot water and sipped slowly on rising every morning. A weekly or biweekly mercurial laxative is also of the greatest service for intestinal antisepsis and I never fail to enjoin it. With some elderly patients, however, castor oil works better than anything else, and should always be tried when mercurials seem to cause more than a day's discomfort. As true cholagogues, we may safely rate the sodium salicylate, the sodium benzoate, and the sodium succinate. I prescribe them constantly together, to be taken for prolonged periods, in doses of 10 gr. each, varied occasionally, increasing the dose by 5 gr. each of the two latter. Larger doses, especially of the salicylates, are not necessary. These powders may be taken with Vichy water. In old persons, with hardened and thickened arteries and weak hearts, 4 or 5 gr. of sodium iodid is a good addition.

Much the most efficient agent against gall-stones is olive oil when properly administered. The true mode of the operation of oils in

cholelithiasis is that there is nothing like oils to produce a watery flow from mucous membranes, whether applied locally or taken internally. No sialogogue can equal a teaspoonful of olive oil held in the mouth, on the principle that the contact of oils on the mouth of any secretory duct will start the flow from that duct. Taken internally, medicinal oils are absorbed into the blood, and, according to their kind, pass out by different mucous membranes, excreting an abundant flow of watery secretions, derived directly from the blood flow of the part, so as to specifically modify their circulation. We see this illustrated in the use of castor oil in colitis, but so general is the action of this oil in increasing the watery action of other tracts also that I consider it a risky prescription to give a dose of castor oil to an infant with bronchitis, which already has more fluid in its bronchial tubes than its feeble efforts of expectoration can raise. The action of olive oil in cholelithiasis I conceive to be this: in the first place, it is a food oil, and as such, if taken in quantity, would not disturb the stomach; thus, 1 or 2 oz. is soon passed into the duodenum to excite there, as all fats do, an increased flow of normal duodenal secretions, namely, the biliary, the pancreatic, and the secretions of Brunner's glands. No larger amount than 1 to 2 oz. is needed for this purpose, though a free flow of watery bile is just what we should aim to secure, with as little disturbance of other functions as possible. For this purpose I direct the oil to be taken in a cup of hot milk at night, the milk greatly assisting the tolerance in the stomach of such a quantity of free oil. To patients with cholelithiasis this dose is taken for ten consecutive nights, then intermitted for about a week to avoid gastric disturbance, and then resumed for ten more nights. The duration of the treatment thus outlined varies according to the previous chronicity of the case.

The gastric derangement accompanying cholelithiasis requires careful management, both dietetically and medicinally. All fried articles are injurious, but one of the worst for exciting an attack is mayonnaise dressing for salads. On general principles, the patient should avoid whatever he has found to be difficult for him of digestion. On the other hand, if gastric digestion is in a fair condition, rigid dieting is uncalled for. For the subacute gastritis which commonly accompanies gall-stones, I have found very serviceable pills of $\frac{1}{20}$ gr. of bichromate of potassium with 3 gr. of bismuth carbonate, one-half hour before meals, and 5 gr. of resorcin in solution, one-half hour after meals.

Indications for Surgical Operation.—The chief dangers which arise from gall-stones are only, in a minority of cases, due to the action of the calculi themselves. This occasionally may be the main factor, yet

many of the worst accidents in cholelithiasis are due chiefly to a virulent sepsis causing ulceration and gangrene, with the most varied disasters as the result. The symptoms, therefore, of this condition are of the first importance, whether we are sure of the gall-stones being present or not, and we should carefully weigh the evidence that gall-stones are the probable cause. But often the existing conditions of the part make a specific diagnosis impossible; therefore, taking the danger-signals in the order of their importance, I would put a continued fever first. The readings of the thermometer are often very characteristic, with all the marked irregularity of sepsis, while the fever shows no resemblance to the transient rise which often follows single paroxysms of biliary colic. In this fever, delirium, even if occasional, is always of grave import. Meantime the pulse continues rapid, without much reference to the temperature, and is generally small. As they progress the constitutional symptoms may be termed "typhoid," including dryness of the tongue and occasional sweats. As before urged, the blood should certainly be examined for a hyperleukocytosis. Local examination should, of course, be as complete as possible, and if tenderness and rigidity are also found there is no excuse for postponing laparotomy. Some may naturally object that it is neither fair to the patient nor to the surgeon to allow a suspected case of cholelithiasis to reach such a perilous condition before having recourse to an operation. The answer is, that at the beginning of such conditions there is commonly no difference from ordinary attacks of biliary colic, which are quite amenable to treatment.

Neither a long history of pain, jaundice, nor emaciation, etc., affords any certainty that such an outcome is imminent, while, on the other hand, such grave conditions develop as often in patients who did not suffer severely from symptoms of cholelithiasis any more than do others.

This has actually been the case in every instance of the kind which I have met with. In one patient, particularly, I made the diagnosis, although no history of gall-stone symptoms was obtainable. The gall-bladder may be found full of both pus and gall-stones, and yet, without any story of attacks of biliary colic and fatal infective cholelithiasis, has been frequently reported without gall-stones being found anywhere at autopsy. I repeat, that it is mainly from infective processes, and not from gall-stones as such, that these perils supervene, and hence the clinical importance of that unfailing sign of a bacterial toxemia—fever. When such a fever cannot be traced to other toxins, such as tuberculosis or rheumatism, and signs of cholelithiasis coexist, the physician should not delay having recourse to the surgeon; his

decision being based not so much on the degree of the fever as on its persistence. Lately, a physician consulted me for obscure hepatic pains, accompanied by four months' fever, which had been daily noted with a thermometer. Though the temperature range had never been high, and the patient kept about the whole time, yet empyema of the gall-bladder was found at the operation in time to save life. I believe also that in every case of those terrible accidents when a gall-bladder or duct bursts, and gall-stones with infected fluid make their way out into the peritoneum, or with their consequent perils, the preceding fever may, though present, have been overlooked.

The history of chills is not, by itself, conclusive of suppurative processes, as these often occur in ordinary attacks of biliary colic, but chills, accompanied by a persistent febrile condition, are of more serious import.

When impacted stones as such furnish the reason for resorting to operation the symptoms are usually definite enough. The first to mention is complete occlusion of the cystic duct, usually by a single large calculus. The gall-bladder then swells, as already described, into a palpable and sometimes very large tumor, caused by secretion from its walls. When that occurs there is little chance of a spontaneous change in the location of the calculus, and meantime there is danger of an infective cholecystitis from bacteria reaching it through the blood. Nothing but a surgical operation can be expected to relieve this condition.

The second condition requiring operation is in cases of chronic obstructive jaundice from impaction by one or more calculi in the common duct. Chronicity is the chief guide here for diagnosis and treatment. Naunyn very justly states that a jaundice lasting more than a year is almost surely due to gall-stones, because new growths causing jaundice will show further progress in other symptoms in less time than that. As before remarked, gall-stone jaundice usually varies in degree from time to time, while jaundice from tumor pressure does not. While the liver may be enlarged with elongation of the right lobe, the gall-bladder, in obstructive gall-stone jaundice, may shrink up to the size of a walnut. The refractory nature to medical means of these long-retained calculi in the common duct is because they become coated with bilirubin calcium, locally produced by chronic inflammation of the walls of the duct, until they actually resemble stones in hardness. If, therefore, a few months of systematic medical treatment does not seem appreciably to relieve such a case, an operation should be advised, not only to forestall local accidents, but to save the liver from that biliary

cirrhosis which supervenes upon long-standing occlusion of the common duct. In some cases an operation may show that the obstruction is due to stenosis of the common duct, caused by antecedent inflammatory processes around it.

CIRRHOSIS OF THE LIVER

This affection assumes different forms which vary in their causation and their course. One form which illustrates a remark already made, that the liver performs more than one function whose etiology is but little known, is well exemplified in a marked cirrhosis of the liver found in all cases in which there is a congenital absence of the lenticular nucleus in the corpus striatum. This nucleus is embedded in one of the most distinctly motor regions at the base of the brain, and its absence has been reported in 14 cases, all of them accompanied by definite symptoms in various parts of the body, but with one accompaniment which is difficult to account for, namely, cirrhosis of the liver. How a virtually brain lesion should cause cirrhosis of the liver I have no idea. (See "Brain," Nov., 1912, Dr. Kinnier's article on "Progressive Lenticular Degeneration.") All forms of cirrhosis of the liver have one characteristic in common, namely, an excess of connective tissue throughout the organ, and the accompanying morbid symptoms can be directly ascribed to this change.

ALCOHOLIC CIRRHOSIS

One of the most frequent examples of the kind is found in what is termed "alcoholic cirrhosis of the liver," in fact, the term "cirrhosis" was first applied by Laennec to this particular affection, but is now more widely applied to analogous changes in which fibrous tissue is increased in various organs, such as the lungs and kidneys, without any reference to alcohol. In nervous tissue the term for this change is "sclerosis." It may be stated, as a rule, that when the cells proper to any tissue so lose their vitality that they die, the omnipresent, but less vital, connective tissue takes the place of the more living cells of the parenchyma of the organ.

There is no agent which so devitalizes living cells as alcohol. When it is present in any considerable amount in the tissues, but notably in glandular and nervous tissues, it first causes premature aging of the cells and then their death. It should be borne in mind, however, that this action of alcohol is in proportion to its concentration. Alcoholic drinks taken upon an empty stomach will pass directly to the liver and affect its cells accordingly. On that account, one of

the worst habits of toppers is to order the American cocktail, which is commonly taken before any food, and I have known of more cases of cirrhosis of the liver thus produced than in any other class in private practice.

The usual change that we find in the liver at autopsy is that the organ is much reduced in size, sometimes to one-quarter its normal bulk. Along with this, the surface is quite nodular, so as to give origin to the old term "hobnail liver." The liver tissue is hard, and cuts more like cartilage, presenting yellow and white patches, the first representing the shrunken liver-tissue, and the paler patches connective tissue. But, besides destruction of liver cells, there is great obliteration of the capillaries of the portal system, leading to two results, the first being the establishment of compensatory channels of the circulation outside the liver, and the second to a dropsical effusion into the peritoneum. Like all forms of edema, the mechanism of this ascites is not clear.

The compensatory circulation is usually readily demonstrated. It is ordinarily carried out by the following set of vessels: The accessory portal system of Sappey, of which important branches pass in the round and suspensory ligaments and unite with the epigastric and mammary systems. These vessels are numerous and small. Occasionally a large single vein, which may attain the size of the little finger, passes from the hilus of the liver, follows the round ligament, and joins the epigastric veins at the navel. Although this has the position of the umbilical vein, it is instead an enlarged vein alongside the obliterated umbilical vessel. There may also be produced, but not very commonly, about the navel a bunch of varices, the so-called caput medusa. Other branches of this system occur in the gastro-epiploic omentum about the gall-bladder, and, most important of all, in the suspensory ligament. These latter form large branches which anastomose freely with the diaphragmatic veins, and so unite with the vena azygos; again, by the anastomosis between esophageal and gastric veins. Veins at the lower end of the esophagus may be enormously enlarged, producing varices which project on the mucous membrane. Besides these, there are communications between the hemorrhoidal and the inferior mesenteric veins. There are numerous other channels which are not constant, but when they exist they may enlarge so as to form retroperitoneal anastomosing channels.

The time occupied in establishing these various vessels of collateral circulation varies in different individuals. If the compensatory circulation is early established it is remarkable how comfortable the

patients may remain for long periods, but the rule is that different morbid symptoms appear in all the viscera connected with the portal circulation.

Symptoms.—Among the earliest are the gastric symptoms, the patients soon showing great disinclination for solid food because of its slow digestion. This is characteristic of chronic alcoholics, until finally they may take only small quantities of any nutriment. I have been struck with the fact that but few cases of delirium tremens take food for a week before their attacks. Others are continually complaining of heaviness, and especially flatulence, after eating. The bowels are either constipated or with frequent small passages. Pains in different parts of the abdomen are complained of, which in some cases are due to localized peritonitis. It is striking on postmortem examination to find how often the intestines are matted together by bands formed during such attacks. But another element comes in, and that is the frequency of tuberculous infection which may occur in the pleura also. A part of the ascites present in these cases may follow upon tuberculous peritonitis, but the dropsical effusion in them is never so great as when due primarily to obstruction in the portal circulation itself. When the ascites is so extreme that it must be relieved by tapping, the days of the sufferers are numbered, for, though this procedure may prolong life by relieving the kidneys from mechanical pressure, yet there is no other chronic disease whose prognosis is so unfavorable. Death usually occurs within less than a year from the first symptom.

As the hemorrhoidal veins are the lowest branches of the portal system it is natural that these should be affected in all forms of hepatic cirrhosis. Hemorrhoids are, therefore, nearly always present, and sometimes they are very troublesome.

In alcoholic cirrhosis, with contracted liver, hemorrhage is common. The bleeding may come from the branches of enlarged veins at the lower end of the esophagus, when it may occasion free vomiting of blood as well as blackening of the feces. However profuse, it is seldom fatal, and is very apt to recur.

It is otherwise with bleeding from the intestines. One case under my observation bled to death while at stool. Another, a prominent city official, dropped dead in the street. At autopsy it seemed as if all the blood in his body had accumulated in his intestines, both small and large, while none appeared outside. Bleeding may often occur from the bowels without hematemesis, and there may also be epistaxis, which is a sure sign of advancing toxemia.

Meantime the aspect of the patient is often very characteristic. He is thin, eyes sunken, with a sallow, muddy complexion, and occasionally actually jaundiced, the conjunctivæ watery, with patches of distended veins on the nose and cheeks. Patches of distended veins resembling nevi may be found on the face, neck, and back, or the veins may coalesce, along with areas accompanied by erythematous discolorations. Though there may be edema of the feet the dropsy is not general.

The cause of death in alcoholic cirrhosis is from brain poisoning. The patients generally first pass into a noisy or muttering delirium, ending in coma. This condition is often mistaken for uremia, which it much resembles, but there are really only a few of the most characteristic symptoms of uremia present, as they are rather approximate to those of cholemia found in fatal cases of jaundice.

Treatment.—The treatment of fully established alcoholic cirrhosis with ascites is, as we have remarked, very unpromising. I have no doubt, however, that I have prolonged life in some cases by stimulation of the circulation in the liver by external applications. One of these is by free faradization of the skin of the abdomen, one pole with moist sponges being applied between the shoulder-blades, and the other passed back and forth over the anterior surface of the abdomen, to be followed by douching of the abdomen by means of large sponges filled with water and then squeezed at a height of 18 inches above the abdomen. These measures should not be tried until after the patient has been tapped. The bowels should be acted upon every day by doses of 40 gr. of the compound jalap powder. Diuretics are useless.

FATTY CIRRHOTIC LIVER

In all cases of cirrhosis, even in the atrophic form, there is a considerable amount of fat in the interstices of the liver tissue. In many cases the organ, instead of being atrophied, appears to be uniformly enlarged. At autopsy, while the connective tissue is much increased, there is a general fatty infiltration between the cells, the organ appearing to be anemic and with a yellowish color very similar to true fatty liver. This form is particularly common among beer drinkers.

SYPHILITIC CIRRHOSIS

I would allude here to affections of the liver in acquired syphilis among adults and not to congenital syphilis in infants. It is remarkable how, in infants dying from prenatal syphilis or soon after birth,

their liver shows a greater abundance of the *Spirochæta pallida* than in any syphilitic lesions in adults.

In acquired syphilis, on the other hand, we may find the liver more distorted than in any other complaint. I once observed in a hospital patient that his liver seemed to be divided by great bands of connective tissue, much as a pillow can be tied up by cords.

These bands are ordinarily produced by syphilitic gummata, which may have disappeared and left behind them streaks of connective tissue. In other cases, however, the syphilitic gummata produce large tumors that may attain the size of an orange, surrounded by a zone of infiltrated tissue, which may radiate in many different directions. By this means a true syphilitic cirrhosis of liver tissue may be generated, the process sometimes being localized with caseous degeneration at the center of the mass. In some cases this softens in time and becomes charged with calcareous salts. If the syphilitic nature of the growth is not recognized it may be easily confounded with cancer. On the other hand, this cirrhotic condition may be so widely spread that it gives rise to ascites which requires frequent tapping, but, notwithstanding the extensive and grave changes in the liver, the prognosis is totally different from that of any other form of cirrhosis, for the most pronounced alterations will give way and disappear under the administration of potassium iodid, and the liver be restored to its usual condition. The doses of the iodid, as in other tertiary lesions, must be large, as much as 140 gr. a day being administered in divided doses. These doses should always be regulated according to the supervention of the symptoms of iodism, for so soon as they appear the dose should be diminished or else suspended altogether. The symptoms of iodism are first a catarrh of the nose and throat, sometimes quite painful. The patients may then pass into a febrile state, with loss of flesh and general debility, soon to recover, however, on modification or suspension of the dose of the drug.

As might be expected from its direct relation to the portal circulation, the spleen is always enlarged in cases of cirrhosis of the liver. This enlargement may be even more pronounced than that of the liver itself in hypertrophic cases and sometimes feels very hard.

Cirrhosis of the liver occurs in children. Occasionally, this happens in alcoholic cases, as in some German families the children are given beer to drink. It may also occur as a primary stage of Hanot's hypertrophic cirrhosis. Its management differs in no respect from that of the other forms of cirrhosis of the liver which we have been considering.

HYPERTROPHIC CIRRHOSIS

This disease was first fully described by Hanot in 1875, and has since gone by his name. It is a puzzle, as no cause can be assigned for it. Thus, alcohol plays no part in its genesis, as the patients rarely give any history of addiction to either spirits or beer. The patients are young, and of an earlier age than in most drunkards. There is a remarkable preponderance of males—22 out of Schachman's 26 cases. The course of the disease is very chronic, much more so than in alcoholics, as it may last for six or even ten years. There is no ascites and no dilatation of the subcutaneous veins. It is not accompanied by either general or localized peritonitis, for there are no adhesions. It is more like a subacute parenchymatous inflammation of the whole organ, for there is often marked leukocytosis with the connective tissue, abounding with small round cells. Jaundice is usually slight, except in the terminal stages. There is bile in the urine, and the stools are not clay colored as in obstructive jaundice. There is no question about its being a cirrhosis, for liver nodules are seen everywhere, separated by bands of connective tissue. On the other hand, the liver cells proper are neither fatty nor pigmented and may be increased in size. The bile vessels, however, are the seat of a general cholangitis and so surrounded by new connective tissue that this affection has been termed "a biliary cirrhosis."

Among the common clinical symptoms are attacks of pain referred to the region of the liver. These attacks occur from time to time, and, when severe, may be accompanied with nausea and vomiting. The jaundice may deepen after these attacks. The liver itself is always enlarged and may extend down to the navel, its lower edge being easily made out and hard. The patients complain greatly of itching of the skin, which may, as in other forms of jaundice, be the seat of urticaria or purpuric blotches, if not of dark pigmented patches. As might be expected, hemorrhages are frequent, and, when severe and recurrent, may be one cause of death. But the usual fatal termination is by cholemia, as in cases of fatal jaundice.

Treatment.—If seen during the ordinary course of the disease, before the terminal cholemia, much may be done by active treatment in the fashion recommended for cholelithiasis. A patient came to my office for hepatic pains that were not paroxysmal, with a uniformly enlarged liver and jaundice, but without any history of biliary colic. An exploratory operation had been performed at one of our leading hospitals, but nothing wrong had been found in his gall-bladder or in the cystic or common duct. He was treated with 10 gr. of sodium

benzoate and sodium salicylate, four times a day, with a mercurial purge twice a week, and 2 oz. of olive oil in hot milk every night. He at once began to improve, and has continued so up to date.

PYLEPHLEBITIS

This affection as a separate condition cannot be diagnosed during life, and can be suspected only when sudden engorgement of the main branches of the portal vein develops without being preceded by the usual symptoms which attend chronic embarrassment of the hepatic circulation, as in a cirrhosis of the liver.

ABSCESS OF THE LIVER

Suppuration in the substance of the liver may occur from various causes. We have already alluded to a widespread infective cholangitis which may supervene on the irritation of gall-stones, and in which the abscesses are small but very numerous. Likewise, in speaking of amebic dysentery, we have mentioned the single large abscess in the liver which follows ulcerative inflammation of the large bowel, and whose nature is revealed by the presence of the specific ameba in the pus of the abscess. This liver abscess often occurs among Europeans in India.

The most common cause in this country of liver abscesses is from infections through branches of the portal system, and classed under the term "pyelephlebitis." Any ulcerative process going on in the rectum, or abscesses in the pelvis or abscesses accompanying appendicitis, may lead to the formation of numerous collections of pus in the liver.

But we may have a single large abscess instead. I once called a well-known surgeon to operate on a patient who presented the following characteristic symptoms. He had long been affected with an irregular fever, when the temperature, from being normal, would suddenly rise to 103° or 104° F., often with a rigor, and after the fever he had profuse sweats.

The liver was enlarged and tender, and the patient always preferred to lie on the right side to prevent a dragging pain, which came on if he turned to the left. He never had dysentery nor lived in a tropical country. The patient looked septic and the pulse remained high, whether he had fever or not. To my chagrin, the surgeon made a long incision in the median line in front, into which he passed his whole hand, and felt the under as well as the upper surface of the liver without finding any sign of fluctuation. After he had sewed the incision up I

told him to introduce a trocar into the liver under the right scapula. This caused an immense abscess to be tapped there. I mention this case to illustrate the clinical fact that single large hepatic abscesses are generally in the right lobe and situated above and posteriorly, which in this case was rendered more probable by a small patch of pleurisy just below the scapula.

Hydatids may occur in any part of the body, and hence in any part of the liver. The cysts which they form in the liver may suppurate and cause large single abscesses, whose pus may then burrow in any direction. I was once consulted for persistent vomiting in a woman, and, on examining the matter ejected, found numerous hooks of the echinococcus. A liver abscess had first formed, which had then burst into the stomach. This patient in time recovered.

ACUTE YELLOW ATROPHY OF THE LIVER

The essential cause of this fortunately uncommon disease is unknown. All we can do is to enumerate its most frequent antecedents. One of the earliest, as well as one of the best descriptions, is by the great physician Bright, who, in 1836, described it as a diffuse inflammation of the substance of the liver affecting the glandular substance more than the connective tissue, leading to marked diminution in the size of the organ, causing jaundice associated with severe nervous symptoms and a special tendency to hemorrhage.

It may occur at any age, but is very rare under ten. Women, however, greatly preponderate over men, and among women the greater number are attacked during pregnancy or soon after parturition. The only case that I have seen was that of a primipara who gave birth to healthy twins. Within a week after parturition she began to be jaundiced, with incessant vomiting but without fever until the last few days, when slight febrile symptoms set in. Hemorrhage under the skin, however, developed in various parts. The diagnosis was made early on account of the shrinking of liver dulness on percussion. In this disease the liver has been found after death reduced to one-fourth its normal size, and leucin and tyrosin appear in the urine. When jaundice sets in it may be either gradual or sudden in its onset, but at last severe nervous symptoms develop, such as violent headache, muscular trembling, and convulsions ending in death, preceded usually by profound coma. The disease evidently is due to a severe toxemia, whose origin and nature as yet are quite unknown, while no successful means for treatment has been devised.

AMYLOID DEGENERATION

Amyloid degeneration when it occurs is a widespread change in the tissues, involving a great many organs, and is in some way connected with conditions of chronic suppuration, hence it is not infrequent after the formation of phthisical cavities. This is well illustrated in amyloid degeneration of the liver, when this organ may be enormously enlarged. Wilkes speaks of such a liver weighing 14 pounds. Its appearance is then so characteristic that it has been called the waxy or lardaceous liver.

Amyloid degeneration of the kidneys is not a form of true Bright's disease, though in its effects and symptoms it may closely resemble it. The kidney alterations are only an accompaniment of the amyloid degeneration in other organs, and in all forms of chronic suppuration whatever its cause. What the connection is between suppurative processes and amyloid degeneration we do not know.

In one of my patients the continued formation of abscesses, originally starting from ulceration of the appendix, led to amyloid degeneration in various organs and parts of the body when he was a young man. When the kidneys are affected we may have an abundant flow of highly albuminous urine, with many of the symptoms of parenchymatous nephritis. In such cases it may implicate the alimentary canal and cause vomiting and diarrhea. As this disorder supervenes upon serious antecedent affections, little can be hoped for by any measures of treatment. Postmortem amyloid change is discovered in the tissues by the characteristic reactions with the tincture of iodine, showing spots of a peculiar mahogany-brown color.

Treatment.—Medicinally, 10 gr. of urotropin should be administered three or four times a day, with the sodium benzoate as before mentioned. (See page 239.)

MOVABLE LIVER

This is a term applied to virtually dislocated portions of the organ, brought about by external pressure, such as by tight lacing in women. A really movable liver, similar to a movable kidney, is impossible, as the organ is so connected at its posterior margin with the inferior vena cava and diaphragm that any great mobility from this point is out of the question.

CHAPTER VIII

DISEASES OF THE SPLEEN

THE spleen is an organ present in all mammals from early embryonic life. What its functions are, however, is quite undetermined. It is well demonstrated that it is not necessary to life or even to well-being, for it has been wholly removed, both experimentally in animals and in man, without injury to the general health. It would seem, therefore, that an organ which is not missed when absent cannot be of great importance when it is present. When, for any cause, it becomes diseased it may be an actual advantage to the body to remove it altogether. These facts give color to the remark of an old anatomist, that the business of the spleen was simply to fill up a hole under the left arch of the diaphragm.

The spleen is prone to become enlarged or hypertrophied in all cases where the liver is similarly involved, but it frequently becomes hypertrophied on its own account, thus splenomegaly is often found in chronic malaria, so as to give the name of *ague-cake*, when it may be found to extend below the umbilicus in front. It is also enlarged in the course of specific fevers, notably in typhoid, and in leukemia, one form of which is called splenomedullary.

When the spleen is itself the seat of disease, as in **Banti's disease**, which ordinarily besides its overgrowth is accompanied by anemia, and a tendency to hematemesis, the best treatment is to remove the organ altogether, whereupon the general health rapidly improves. We may say, in short, that the spleen seems to act as a reservoir of waste products; thus, it is supposed to be largely connected with the final destruction of worn-out red corpuscles, and by many is supposed to be the depositing place of uric acid and similar waste products. In the so-called Banti's disease the skin is prone to be discolored in extensive patches, and if it occurs in childhood bodily growth is interfered with.

Polycythemia is a condition in which, with an enlarged spleen and cyanosis, there is an extraordinary increase in the number of the red blood-corpuscles, up to 9,000,000 to 13,000,000 per c.mm. Headache, giddiness, and constipation are the common symptoms. The patient, especially when it is cold, may appear very cyanotic. This may last for many years without seriously affecting the health. Its etiology is wholly unknown.

CHAPTER IX

DISEASES OF THE PANCREAS

No single gland in the body compares with the pancreas in the varied properties and activity of its secretion; that secretion acts upon the proteins, the fats, and the starches, digesting them all.

In our discussion of the etiology of gastroduodenal ulcers we referred to the question why the stomach does not digest itself. This question is even more natural in the case of the pancreas, with its more powerful and varied secretions, and, in fact, such autodigestion of the pancreas is found in fully 50 per cent. of all cases after death, while the stomach is found so only when death occurs during digestion. We shall see that in 75 per cent. of cases of death from lesions of the pancreas itself a preceding autodigestion was the cause of the fatal issue. It is fortunate, however, that this accident is uncommon, though why so is difficult to explain, except on the same principle, as in the case of the stomach, that the system generates antibodies, such as antipepsins, antitrypsins, etc.

The situation of this gland is in the epigastrium, with the stomach above and the transverse colon below. Its secretion in man is limpid and colorless, always alkaline in reaction, with a specific gravity of 1.0075. In all mammals it is one of the most abundant secretions in the body, amounting in the cow to between 1½ liters, and in man from 500 to 800 c.c. per diem, according to the food taken. In man it enters the duodenum by one duct, called the duct of Wirsung, entering the intestine conjointly with the bile, descending through the common bile-duct, which has a slight dilatation at its end called the ampulla of Vater. This fact explains why so many enlargements of the head of the pancreas, such as by tumor or cyst, are accompanied by jaundice. Another important fact connected with the pancreas is that it contains separate and distinct collections of special cells, which constitute what is termed the "islands of Langerhans." The secretions of these islands have nothing to do with the pancreatic secretion coming off through the duct of Wirsung, for they discharge their secretions internally, directly into the blood. These secretions have an important bearing upon the changes of the carbohydrates into sugar, when disease and atrophy of these structures lead directly to an intractable

form of diabetes mellitus. A deficiency in the pancreatic secretion causes the stools to become either oily in consistence or grayish in color. In some cases there seems to be a total inability to digest the fats, so that they constitute a large portion of the feces. There is, however, a remarkable variability among different persons in their powers to deal with fats. Some may show large quantities of undigested fats in their stools for many years without appearing to be out of health.

Failure in pancreatic secretion also shows the presence of undigested protein or meats in the stools. While 5 or 6 per cent. of the undigested proteins in the feces is of no moment, in pancreatic disease the undigested proteins may amount to from 30 to 40 per cent. in the stools. In both these conditions, whether of fat or protein failure of digestion due to pancreatic disease, the general nutrition soon suffers.

PANCREATIC HEMORRHAGE

We now turn to those fatal accidents which we have already referred to caused by the autodigestion of the pancreas by its own secretion. These may occur as a direct result of a perforation, by a duodenal ulcer, or from obstruction to the outflow through Wirsung's duct; in some cases possibly by regurgitation of bile from the bile-duct. One of the first results is hemorrhage into the substance of the pancreas, which, if due to autodigestion of a large artery in the gland, may be the speedy cause of death. When the bleeding is extensive the entire tissue of the gland may be destroyed, and the hemorrhage accumulates in the retroperitoneal tissue. The patient may be quietly resting, when he is suddenly seized with a very severe pain referred to the upper part of the abdomen. This pain steadily increases in severity, and is accompanied from the first by nausea and obstinate vomiting, which vomiting gives no relief. The patient becomes anxious, and only with difficulty can be restrained in bed. The body is cold and the forehead is covered with a cold sweat. The abdomen becomes tender, more especially in the epigastrium, occasionally with rapid development of tympanites. The pulse becomes very weak, small, and rapid till it ceases with the advent of death.

Symptoms.—These are well described by Prince as follows: "The patient, who has previously been quite well, is suddenly taken with the illness which terminates his life. . . . When the hemorrhage occurs the patient may be quietly resting or pursuing his usual occupation. The pain which ushers in the attack is usually very severe and located in the upper part of the abdomen. It steadily increases in severity, is

sharp, or perhaps colicky, in character. It is almost from the first accompanied by nausea and vomiting; the latter becomes frequent and obstinate, but gives no relief. The patient soon becomes anxious, restless, and depressed; he tosses about, and only with difficulty can he be restrained in bed. The surface is cold and the forehead is covered with a cold sweat. The pulse is weak, rapid, and sooner or later imperceptible. The abdomen becomes tender, the tenderness being located in the upper part of the abdomen or epigastrium. Tympanites is sometimes marked. The temperature is usually normal or subnormal. The bowels are constipated."

Another striking evidence of autodigestion, to which we have referred, is found postmortem in large areas of fat necrosis, both in the pancreas itself and in the surrounding tissues, such as in the mesentery, in the omentum, in the abdominal fatty tissue generally, or even in the pericardial and subcutaneous fat. These necroses show a dead white color, and may be of all sizes, both very small and quite large. When cut into and examined, besides the remains of fatty tissue, there are always found lime salts.

ACUTE PANCREATITIS

In some cases the symptoms which we have described are preceded by signs of acute inflammation, the symptoms of which are characterized first by their suddenness, with violent colicky pain, in the upper part of the abdomen accompanied by nausea and vomiting.

"Acute pancreatitis is to be suspected where a previously healthy person, or a sufferer from occasional attacks of indigestion, is suddenly seized with a severe pain in the epigastrium, followed by vomiting and collapse, and, in the course of twenty-four hours, by a circumscribed epigastric swelling. Localized tenderness in the course of the pancreas and tender spots throughout the abdomen are valuable diagnostic signs" (Fitz). In some cases the above-mentioned lesions of the pancreas lead to the formation of a localized abscess. In other cases instead of a single abscess there are numerous small abscesses. It is always a suspicious sign to find, with early symptoms of this condition, a tumor-like mass in the epigastrium, whereupon a laparotomy should be immediately performed, for this has resulted in saving life, even when extensive fat necrosis surrounded the abscess. The course of suppurative pancreatitis may be much more chronic than in the acute cases above mentioned. But, as we might expect, we have also gangrenous pancreatitis from any of the above causes of pancreatic lesions which we have mentioned. Korte has collected 40

instances in literature. Such cases end in collapse and death in from ten to thirty days.

Owing to the numerous small passages throughout the substance of the gland for secretion it is natural that when any one of them is closed that pancreatic cysts should be formed. These may grow quite rapidly into marked rounded tumors, showing fluctuation from their fluid contents, which then will produce local symptoms from their pressure. Once in my hospital service I had a patient who developed a considerable tumor, situated between the stomach above and the transverse colon below. This tumor was not displaced by the descent of the diaphragm during inspiration, which fact showed that it was not connected with the liver. Accompanying the tumor was intense jaundice and also glycosuria. I, therefore, diagnosed it as being a pancreatic cyst, formed in the head of the pancreas, which would account also for the jaundice. I had the patient at once operated upon by my surgical colleague, Dr. McBurney, who drained the cyst, and this quickly relieved the patient of his jaundice and of the sugar in his urine, so that he made a rapid recovery.

CHRONIC PANCREATITIS

Some of the cases of this condition are remarkably local and wholly devoid of symptoms, so that it may not be discovered until after death. Thus, Mayo Robson reports a series of cases in which the head of the pancreas was so hard as to resemble scirrhus cancer, but this condition may be strangely compatible with good health until the resulting tumor presses upon the main pancreatic duct, necessitating, therefore, surgical operation to restore the flow.

Chronic pancreatitis occurs, however, in two forms, one of which is interlobular and the other interstitial, leading to general sclerosis of the gland. It is remarkable that in this condition the islands of Langerhans frequently escape, so that diabetes does not develop. In other cases, however, diabetes does result from these structures being involved, though it is strange that, if only a few of the islands of Langerhans escape in the tail of the pancreas, that those few cells are still sufficient to prevent glycosuria, as we have already remarked.

PANCREATIC CALCULI

These sometimes form in the duct of Wirsung. The concretions differ altogether from biliary calculi in that they are composed of carbonate of lime. They do not produce any characteristic symptoms which may lead to their diagnosis during life.

CHAPTER X

DISEASES OF THE URINARY APPARATUS

ACUTE NEPHRITIS

THE kidneys are the most paradoxical organs in the body, in a sense that gross anatomic lesions may occur in them and yet produce results just the opposite from those we would naturally expect. Thus, J. Rose Bradford removed two-thirds of the substance of each kidney, but the remaining third, instead of showing a corresponding loss in its functions, excreted much more urine and far more urea than would normal kidneys. The only explanation would seem to be that this injury to the kidneys started a general breakdown of the muscular tissues into urea, which is the final outcome of muscular metabolism. If we regard the elimination of urea as the chief function of the kidneys, this experiment would at first sight indicate that a part is much larger than the whole. On the other hand, physiologists have demonstrated that it is the liver, and not the kidneys, which produces urea, and that the kidneys simply remove the urea from the blood, but this experiment indicates that the small portion of kidney substance left leads to a great increase in the formation of urea without the liver having anything to do with it.

The second peculiarity is that we have double the quantity of kidney substance that we need. I knew a man who lived in good health for thirteen years without knowing that he had only one kidney to go by, the other having been ruined by a calculus impacted in its ureter, with the usual results of complete destruction of the gland. After thirteen years he had a similar calculus close his remaining ureter, so that not a drop of urine reached his bladder for nine days until I saw him, when he told me that he felt quite well. He then had no sign whatever of kidney trouble, nor, indeed, of any other trouble. I could note only that his pupils were symmetrically contracted, and that he had a few muscular twitchings. I told his physician that the man would soon die unless he would cut down on the impaction and free the ureter of it. This he declined to do, though he was a hospital surgeon, unless the patient showed signs of uremia. I answered that the man would die without any signs of uremia, and so he did, appa-

rently from pure asthenia and conscious to the last. These and other like facts, also, show how much we have yet to learn about the kidneys.

Causes.—We prefer, therefore, to take up the ordinary affections of the kidney seriatim, and begin with acute nephritis. A common cause of this affection thoroughly illustrates the mechanism of Catching Cold, which is the subject of our first chapter. The vasomotor nerves, distributed through the skin, over the kidneys, both anteriorly and posteriorly, show in their action how sensitive the kidneys are to the surface impression of cold as well as of other surface irritations. Years ago I read a paper by Brown-Séquard, in which he stated that he roused a patient from uremic coma by the light application, over kidneys before and behind, of spoons dipped in boiling water. I soon had a test which proved the efficacy of this measure. A boy twelve years of age had acute suppression of urine following an attack of scarlet fever. Every measure tried to restore the secretion had failed, until after eight days of total suppression he had a convulsion. A physician, who was then called in, pronounced the boy dead, for he did not respond to brushing of his eyes, nor could he be made to gag by introducing the finger into his fauces. When I came in I ordered several table-spoons to be dipped in scalding water, and repeated these touches as Brown-Séquard had advised. After ten such applications the boy opened his eyes for a moment. I then gave a high enema of normal saline, whereupon, as it acted, he passed a small quantity of bloody urine. I afterward received the wedding card of this patient.

A typical form of acute nephritis occurs, as we have already described, as a comparatively late complication of scarlet fever. This does not develop during the height of the fever, but usually from two to four weeks after its onset, and it occurs without any reference to the severity of the primary attack, for it may follow upon such a mild onset that the child can scarcely be kept from its play. In my experience, the earliest symptom of its approach is a diminution in the amount of urine passed, and I have noticed this to be unaccompanied by any other symptom, the urine being free from albumin and quite clear or colorless. Very soon after this edema shows itself in the face, and the first untoward symptom may be an attack of vomiting. The urine then progressively diminishes and often is bloody, until, finally, total suppression may occur accompanied by fever. The dropsy may then become quite general, but there are cases in which there is no dropsical period; the pulse, however, is of high tension and very small, as it has been all along in this fever. At autopsy the organ

is found much enlarged, though its capsule remains non-adherent. On cutting into it the kidney is found surcharged with blood, and, on further examination, the glomeruli are completely congested, the cells lining Bowman's capsule being greatly swollen, while the lining cells of the tubules are similarly affected, the tubes being stuffed with detached epithelium and blood-corpuscles. Throughout the organ also an abundant infiltration of leukocytes and of small cells shows the intensity of the inflammatory process. The interstitial tissue is likewise affected and the pyramids stand out red, their tubes filled with blood.

When recovery takes place the first favorable symptom is an increase in the secretion of urine, from which the blood, and then the albumin, and later the tube-casts, gradually disappear. This process, however, may take some time, and, in some instances, it is never complete, the affection of the kidneys becoming essentially chronic and may last a lifetime. The practical point, therefore, in the treatment of acute nephritis is to prevent the disease from becoming chronic, although the supervention of chronic disease upon acute nephritis is exceptional.

As we have already intimated, acute nephritis may have its origin literally from the kidneys catching cold. The initial irritation of cold may begin with the wetting of the feet, as we have before explained, and some of the worst cases may be traced to this cause. It is not necessary, therefore, that acute nephritis from cold should always begin by exposure of the skin over the kidneys, but, once induced, acute nephritis from catching cold may differ but little from that which is a sequel to scarlet fever, the only difference perhaps being the greater tendency of such nephritis to become chronic. Hence, the frequency of kidney disease in hospital patients who have often been exposed to sudden changes in the weather in their various avocations.

Treatment.—As to the prophylaxis of acute nephritis following scarlet fever, it is noteworthy how difficult it is to devise any measures which will prevent this complication. Children who have been most sedulously kept indoors seem to be just as liable to the attack as those who have had no care taken of them.

We shall have frequent occasion to note the advantage of careful attention to the functions of the skin in all forms of disease of the kidneys. There is an intimate association between the skin and the kidneys, which is known to all persons by the difference in the quantity of urine excreted during cold and during hot weather. I have, therefore, been accustomed systematically to use oily inunctions of the

skin in all kidney diseases which affect the general nutrition. This ancient practice of anointing the skin was once universal, and there can be no doubt that its discontinuance in modern times has had its disadvantages.

As might be supposed, the first indication in acute nephritis is to restore and to increase the secretion of urine. This is best done by persevering irrigation of the colon with hot normal saline. Kemp's rectal irrigator, with its double flow, both in and out, is the best mechanism yet devised for this purpose. The bag of the fountain syringe, filled with the water, should be attached to the irrigator, and from 2 to 4 gallons of water, at a temperature of 115° F., or even 120° F., should be employed. We have no means equal to this for restoring the diminished flow of urine from whatever cause. At the same time, dry cupping of the kidney region, both anteriorly and posteriorly, should be employed. In adults, if other means fail, venesection should be employed. After the skin also has been well oiled a warm bath may be administered of from ten to fifteen minutes. As soon as the urinary secretion is established hot drinks should be given freely, plain water itself being one of the best diuretics. I have found also profuse sweating, produced by $\frac{1}{8}$ gr. of pilocarpin, sometimes very efficacious, but care should be taken with this agent if the heart is weak. Medicinal diuretics should be only of one class, viz., an infusion of digitalis, and from two teaspoonfuls to a tablespoonful once every three hours, with 1 gr. of calomel rubbed up in sugar and divided into six doses, one to be taken every fifteen minutes.

After convalescence has been established iron should be administered, of which for children the syrup of the iodid, in half-teaspoonful doses, is the best preparation.

CHRONIC NEPHRITIS

No organs of the body present such a variety of chronic affections as the kidneys. The same may be said also of the accompanying clinical symptoms, or even the want of such symptoms. Some persons may pass years with steady progress of the processes of interstitial nephritis without being aware of the serious nature of their disorder, until suddenly, and without warning, fatal uremic symptoms develop.

Chronic diseases of the kidneys are commonly classified according to the conditions in which a kidney is found at autopsy. We begin, therefore, with that affection called the large white kidney.

Symptoms.—The synonyms of this affection are chronic parenchymatous nephritis, chronic desquamative and chronic tubal nephritis,

and chronic diffuse nephritis with exudation. These names are supposedly based upon the changes in the kidney substance found at autopsy. They do not, however, correctly describe the affection itself, because in all cases of supposed chronic parenchymatous nephritis there is always found a marked overgrowth of the interstitial or connective-tissue elements, varying both in degree and in situation. In some places the interstitial changes are marked, while in others the alterations in the parenchyma of the organ are the most in evidence. The accompanying clinical symptoms are really more characteristic in this disorder than the anatomic description would indicate. Those symptoms are, first, a copious discharge of albumin in the urine, but still more characteristic is the general anasarca or dropsy which in this form is usually extreme. We have no explanation of the mechanism of this dropsy any more than in any other condition of edema, but, in general, its characteristics are these, that, instead of cardiac dropsy, which usually begins first in the lower extremities and increases upward, renal dropsy shows its earliest signs in the face, and notably in the eyelids and other loose tissues about the face. It is an illustration of a variety of conditions in Bright's disease that in chronic interstitial nephritis there is usually no dropsy whatever and scarcely more than traces of albumin in the urine.

Accompanying the dropsy there is a marked anemia, very evident in the face, but what is not so evident at first is the wasting of the muscular tissues. This may be concealed by the swelling of the body, but, should the edema subside from any cause, the general emaciation becomes very evident. The accompanying anemia is best explained by the severe toxemia destroying the blood-corpuscles, but it also explains the general weakness and prostration of the patients, so that they are wholly unable to stand or walk and are obliged to take to their beds.

Local troubles also develop in the skin, such as erythema or even cutaneous eruptions, often accompanied with intense itching. In some cases even bullæ may form, which constitute serious complications in the course of the disease. All these are more or less caused by the mechanical interruption of the blood-supply to the skin by the presence of subcutaneous edema, and, therefore, as you shall see, are to be early treated by proper attention to the devitalized skin.

As we have remarked, the clinical accompaniments of the different forms of chronic Bright's disease are much more distinctive than the findings in their morbid anatomy. Thus, clinically, no contrasts should be greater than between what is called chronic parenchymatous

nephritis and chronic interstitial nephritis. In the first the most prominent feature is the dropsy, which, beginning with swollen eyelids and puffy features, soon passes into a general and often extreme anasarca, till the skin may burst from the fluid distention. Marked pallor from anemia is also present. In interstitial nephritis anemia is not often recognizable, nor is there any dropsy whatever. In parenchymatous nephritis the urine may at first be scanty and of high specific gravity, to become later more abundant, but always there is abundant quantity of albumin which no known measures can diminish. In the interstitial form the quantity of urine is abundant, but of low specific gravity, while albumin may not be present at all or be only in small quantities. The contrasts in the history of the patients is greater still. Those sick with parenchymatous nephritis soon have to take to their beds. With interstitial nephritis they may go for many months, quite unaware that anything is the matter with them, and continue to pursue their avocations just as usual, until suddenly an explosion, as it were, of apoplexy soon takes them off. One symptom in chronic interstitial nephritis, though occasionally present in the terminal stages of other forms, is a staring expression of the eyes caused by immobility of the iris. The expression of the eyes is due to rapid changes in the iris, but in all uremic states the iris is well-nigh immobile to emotions, though less so to light.

Besides these two forms of chronic parenchymatous nephritis and of the interstitial nephritis, ending in the shrunken red and granular kidney, there is a form, described particularly by Rose Bradford, of the small contracted white kidney.

Here, again, the clinical facts are the most distinctive of this particular affection, because, instead of occurring as the red contracted kidney does, chiefly after middle age, the white contracted kidney occurs among adolescents or in young adults. Unlike the case with the large white kidney, dropsy may not be present at any time in the course of the disease. Albumin is also not so abundant in the urine. Meanwhile the cardiovascular changes, though present, are not so pronounced as in the contracted red kidney. It cannot be said that the small contracted white kidney is a sequel to the large kidney, because the clinical accompaniments are quite different, besides the features which we have mentioned of their general occurrence in young adults. Anatomically, a small white kidney presents a great shrinkage in the cortical layer and a wasting or disappearance of the tubular structures. On stripping the capsule the organ seems quite granular, resembling the contracted red kidney, except in color. The usual

clinical cause is progressive general ill health, with marked anemia, loss of appetite, various digestive disorders, and finally death, with uremic symptoms, though convulsions are much less common than in the course of chronic red contracted kidney.

Treatment of Parenchymatous Nephritis.—This affection, on the whole, is the most difficult to treat of all renal derangements, owing to the obstinacy of the dropsy and the liability to serious complications. Often the first of these developments in the alimentary canal, such as vomiting, may of itself cause the death of the patient. At first drop doses of Fowler's solution of arsenic may be given every fifteen minutes until six doses have been taken, when it should be intermitted. The next measure to deal with the vomiting is by a purge of 5 gr. of calomel and 35 gr. of compound jalap powder. As soon as the bowel has been evacuated the patient should take $\frac{1}{2}$ oz. of equal parts of milk and lime-water, or, if this disagrees, simple barley-water. Occasionally drop doses of the tincture of ipecac may be taken instead of Fowler's solution. It is not uncommon, however, for diarrhea to occur along with, or shortly after, the vomiting. In some cases the diarrhea is due to a diphtheric inflammation of the colon, in which membranous exudations may be discharged by the rectum. When this occurs I know of no remedy better than the turpentine and nitrate of silver pill, recommended in the treatment of hemorrhage of typhoid fever. It is also in these cases that mutton suet, tied up in a rag and boiled in milk, will be beneficial, as it is in chronic ulceration of the intestine.

The chief indication, however, is to relieve the kidneys by action of the skin. We should here explain that perspiration is interfered with more effectively by subcutaneous edema than by anything else which can happen. This is because the edema mechanically closes the sweat ducts of the skin, as these ducts always open on the surface, not directly, but obliquely, and hence the subcutaneous fluid, acting directly from within, effectually closes them. I, therefore, always recommend that the skin should be thoroughly oiled, along with active friction, before any agent for diaphoresis should be used, because the epithelial layers of the skin are, by the oiling, mechanically separated, and thus relieve the subcutaneous pressure of the fluid. These patients should always wear flannels both summer and winter, and at night sleep in cotton flannel, while those who can afford it should spend the winter months in a warm climate. The diet also should be carefully regulated; fruits and vegetables being generally employed, with certain exceptions to be noted. Among the fruits, grapes are justly celebrated,

but they must be the grapes of a warm climate, and not the Concord American grapes, which have a tough, acid pulp about the seed absent in California and Malaga grapes. Onions, particularly Bermuda onions, are an excellent article of food. Apple-sauce is the only form in which apples should be taken. Beans, on the other hand, especially Boston baked beans, and among the cereals, oatmeal, should be forbidden, while fish and poultry may be taken in moderation. Boiled fish, however, and the oily kinds, like salmon, are indigestible. Fermented milk in its varied preparations should be the ideal food, if it were not that, in severe cases of dropsy, it is sometimes necessary to limit the intake of all fluids. Coffee and tea in moderate quantities are allowable. In some cases salt has to be left out.

The remaining affections of the lower genito-urinary tract, such as affections of the prostate and of the urethra, are so commonly surgical in their nature that they do not properly come within the scope of this work. I would only allude to the fact, that in elderly persons the enlarged prostate is covered in some cases with dilated veins, from which hemorrhage frequently occurs. Usually this hemorrhage is very moderate, but enough to attract the notice of the patient and lead to his seeking advice about it. When moderate it should simply be left alone, because it causes no inconvenience. One gentleman, however, came into my office with his urethra full to the meatus with coagulated blood. This bleeding recurred with him at intervals of several months, until finally he was cured by excision of the prostate. It should be remarked that every outlet from the body should invariably be free, because even its partial occlusion leads to serious results. This applies as much to the air-tubes as to the outlet of secretions. A small constriction in the course of a main bronchus, whatever its cause, leads to serious affections of respiration; so polypi in the nose are often the causes of asthma. One of the most singular illustrations consists of a too small orifice to the prepuce in young boys. I have repeatedly found that this obstruction reacts upon the spinal cord, leading to disturbances which require circumcision. Circumcision, indeed, is a hygienic measure which should be universally adopted. But, on the same principle, no person who has a stricture of the urethra is a healthy man, and at any time this may give rise to complications whose nature may be extremely serious.

CHRONIC INTERSTITIAL NEPHRITIS

One feature in the pathology of chronic interstitial nephritis which separates it from all other affections of the kidneys is the

concomitant change in the whole arterial system. The arteries are everywhere thickened by a process which may finally obliterate entire areas of arterioles. It is often difficult to decide whether this arterial change does or does not precede the sclerotic changes in the kidneys themselves, the most probable view being that both these alterations are simultaneous and due to the same general cause.

The arterial changes are everywhere observable. The radial artery, for example, is easily palpable in its bed as a more or less hard cord, which may be uneven or bead-like if atheromatous changes in its walls have taken place. Meantime the effects of obstruction in the blood-flow is readily perceptible. The pulse feels hard and incompressible, as water flowing through a hose would resist pressure if its stop-cock were partly turned. One result of this difficulty in the circulation should be early recognized in the enlargement of the left chamber of the heart, both downward and to the left. The most easily noted changes, however, are in the circulation of the skin. Thus, that of the abdomen is preternaturally white, and is not readily reddened by drawing the nail over it.

The radial artery, however, may be palpable and the pulse feel incompressible, without any thickening of the arterial wall. This may be recognized by two fingers compressing the radial above while the index-finger is left to feel the emptied artery beyond the point of compression. If the arterial wall is itself thickened this is then felt much as before, but, if the vessel be only overfilled, the part is then simply collapsed.

This observation is important, because it brings in a new element not heretofore alluded to.

Next to the heart itself the arteries constitute the most living portion of the circulatory apparatus, because they are richly supplied with their vasomotor nerves, which both contract and dilate these vessels. The whole arterial system, therefore, may be overfull, on account of general vasomotor contraction, and, therefore, not due to organic thickening of the arterial walls. Undoubtedly, this condition may exist for a long time before resultant organic changes develop in the walls of the vessels. It is at this time, therefore, that measures should be adopted to relieve the vessels from strain before structural changes in the arteries have occurred. To this condition the term "angiospasm" has been given, but, clinically, it is important to note that angiospasm may be very local and not general, and there can be no question that many cases of rupture of a diseased artery, such as in apoplexy, may be caused by local angiospasm of the cerebral

arteries. We often meet with illustrations of local angiospasm causing repeated attacks with cerebral symptoms which may be explained only in this way. Thus, I have known of patients having as many as ten to thirty attacks of true but purely local apoplexies in the cerebral hemispheres.

Here, as elsewhere, prophylaxis is so important, by the employment of those remedies which are true vasodilators, of which, as we have remarked before, aconite and veratrum viride are the most efficacious agents. Even if sclerotic changes have already occurred in the blood-vessels, the prevention of angiospasm is of great practical importance. It is not improbable that the prolonged history of an active business life, in persons with chronic sclerotic thickening of the arteries and similar changes in the kidneys, is to be explained by the absence in them of attacks of angiospasm, until the slow accumulations in the blood of uremic poisons, like other blood-poisons, suddenly explode with fatal symptoms.

One very common accompaniment of chronic interstitial nephritis is polyuria. I have had such cases consult me for this symptom alone because they had to rise so often at night to pass water. In fact, this may be the earliest symptom of the onset of the disease in the kidneys when it cannot otherwise be accounted for by enlargement of the prostate.

Gouty Nephritis.—Chronic interstitial nephritis occurs in many cases of gout, so that authors, especially English, speak of gouty kidneys as such. We should not expect the kidneys to be always affected in gouty diseases, because many cases may suffer from arthritic gout for many years and yet never be affected with gouty kidney. Nevertheless, the two affections do occur so often that it is proper to speak of gouty nephritis as a distinct affection, characterized by deposits of acicular crystals in the kidneys, especially in the pyramids, which in some instances appear to be encrusted by them. The treatment of these cases, however, does not differ from that already detailed, except that such patients should be freely dosed with the citrate of potash, as hereinafter prescribed, for the treatment of uric-acid gravel.

Treatment.—No kidney disease calls for such sedulous attention in the way of treatment as interstitial nephritis. By proper therapeutic measures many a useful life may be prolonged for years by observing dietetic rules and by persevering in the use of medicinal remedies.

In the first place, the damaged kidneys should be relieved as far as possible in the work which they have to do. For this purpose all red meats should be avoided, as it is by such articles of diet that

damaged kidneys are called upon to do the most work. As nitrogenous elements in our food are absolutely necessary, we should choose the least exacting of such articles; on that account preparations of fermented milks are the best adapted, both for nutrition and for prevention. Diseases of the kidneys, in fact, are rare among those races who habitually use fermented milk, such as the people of western Asia and the pastoral Tartar and Bedouin tribes.

On the other hand, most cereals, with the exception of oatmeal and all succulent vegetables, can be taken freely. Such preparations as baked beans are not easily disposed of by the intestines, while string beans are allowable.

I had a patient so far advanced in this complaint that she had albuminuric retinitis, with occasional bright scotoma, until she could not see clearly across the room. I had her rubbed all over the body twice a day with cocoanut oil, and interdicted the use of indigestible vegetables, like beans, until albuminuric casts disappeared from the urine. One day, however, as she had from childhood been very fond of baked beans, she partook of them at noon. That night she was taken with severe pains in the bowels, and the next morning showed a heavy precipitate of albumin in the urine, which did not disappear for three weeks. This patient lived for more than twenty-five years afterward in good health. I mention this case particularly to enjoin that the utmost care in the treatment of kidney disease should be taken in the management of the intestinal canal. We have already alluded to this subject in our article on Infections by the *Bacillus Coli*, and I have no doubt that a large proportion of all cases of chronic interstitial nephritis are induced and kept up by disorders of intestinal digestion. For the same reason, asparagus should be avoided, because all persons will show a quantity of crystals of oxalate of lime in the urine first passed after taking asparagus.

In all cases of chronic interstitial nephritis, 10-drop doses of the tincture of aconite of the Pharmacopeia of 1890, four times a day, should be persevered in continuously. I have had a number of cases who immediately felt the loss of this valuable vasodilator whenever they omitted their aconite doses.

Corrosive sublimate, in doses of $\frac{1}{24}$ gr. three times a day, should be taken systematically for ten days or two weeks, and then intermitted for the same period and then resumed. I have repeatedly known the watery urine of this disease to assume a natural color while using this drug. When it is intermitted, a dose of 5 gr. of sodium iodid should be taken instead three times a day.

ARTERIORENAL SCLEROSIS

Sclerosis of the arteries and wasting of the kidney substance consecutive to chronic interstitial nephritis are so frequently associated together that it may become difficult to decide which of these processes came first.

Clinically, it sometimes seems as if the arterial disease was the true antecedent. This is very different from the same procedure in a chronic febrile complaint, like tuberculosis, and it indicates that whole areas of arterioles have become obliterated. Examination of the larger arteries, such as the temporal and radial, shows them to be thickened and often tortuous in their course. The pulse also is hard or not easily compressible, and the heart is hypertrophied with accentuation of the second sound at the origin of the aorta.

Coincident with this widespread vascular disease the kidneys develop symptoms which are highly characteristic, both negatively and positively. The valuable danger-signal of pain is absent. It is surprising how far the kidneys may become disorganized and wasted without the patient being aware of it until it is too late to attempt to do anything for him. All that he has noticed is that he is passing more water than usual, nor is examination of the urine necessarily decisive. I had a patient whose urine was repeatedly tested at the Harvard Laboratory when she went to her country place near Boston, and it was uniformly reported that there were no traces of albumin nor even of casts. She had been a patient of mine for years, during which I gave an unfavorable prognosis, because the elimination of urea was persistently low. At last she suddenly became uremic and died. Meantime all her arteries which were palpable appeared to be normal and not thickened, and the heart was not at all hypertrophied. In this case, therefore, the disease began in the parenchyma of the kidneys and did not involve the general arterial system. This case shows that it is not enough in urine examination to determine whether it contains abnormal ingredients, but also whether its normal constituents are present in their proper proportions.

We know that in cases of obstructive suppression, when a calculus is impacted in the ureter which leads from the one remaining kidney after the other kidney has been destroyed, that death follows without a symptom of uremia, such as headache, vomiting, or convulsions, the patient dying instead with symptoms of simple asthenia, the mind being unaffected to the last.

We may say, therefore, that uremia is not at all synonymous with

the retention of urea. Other changes have to follow before suspension of the elimination of urea will cause what we call uremia.

Treatment.—In some cases, in which we do not doubt that sclerosis or shrinkage of the kidney is present, we may yet be uncertain whether enough kidney substance may not still be left unaffected, so that life may be prolonged or even preserved if only we could get those parts of the kidney to perform their functions. This is because everyone has much more kidney substance than he uses or needs, because anyone can live with only one kidney. It has long been known that vasodilators, like amyl nitrite and nitroglycerin will temporarily improve the symptoms of these patients, but the drawback is that the vasodilator action of the nitrites is very transient, as a rule not lasting half an hour, if so long. What we need is both a more powerful and a more continuous vasodilator than they. Our present object is to show that we possess in aconite, and to a lesser degree in veratrum viride, the best vasodilators. That this is no theory is shown by the fact that the regular administration of full doses of aconite is followed by an increase in the output of urea by the kidneys equal to double or treble the amount excreted before the administration of this drug. (See Arteriosclerosis, page 265.)

UREMIA

This is a well-known morbid condition, but its actual etiology is quite uncertain. It surely is not due to the simple retention in the blood of urea or of its decomposition there, for I have known of cases of parenchymatous nephritis with dropsy in which the excretion of urea by the kidneys was but little below the normal, and yet the patients died from pronounced uremia. Further, when not a drop of urine reaches the bladder, on account of complete stoppage by calculus of the only remaining ureter, the patient dies at periods ranging from seven to twelve days of total suppression, with symptoms only of pure asthenia, without a single one of the characteristic signs of uremia. Moreover, a patient with chronic interstitial nephritis may go for months in apparently good health and then suddenly develop all the symptoms of uremia and soon die in them. These facts have caused a great number of theories to be advanced to account for this serious condition, but none of them afford a fully satisfactory solution.

Symptoms.—Acute uremia may come on in any form of nephritis. Its symptoms in some cases may develop very gradually, and in others suddenly and without warning. For convenience, we can divide these

symptoms into cerebral, circulatory, and gastro-intestinal, though cases occur in which all three forms rapidly succeed one another.

Cerebral Symptoms.—A group of these take the form of sudden insanity. Thus, a patient of mine, who a few weeks previously had caught cold standing on the wet ground in the cemetery at the funeral of his wife, first had an attack of pleurisy with effusion, from which he so far recovered that he returned to business, and then one day went to his bank and without reason upbraided the officials for refusing to cash one of his checks. He was then sent home, and I was summoned to see him. I had great difficulty in persuading him to go to bed, but, after doing so, he refused to get out of bed again on any pretext, passing his motions in bed, and maintaining that he had gone there by my orders and there he was going to stay. Meantime I examined his urine, and found it highly albuminous with casts. He gradually recovered from this condition, so that he went about, but was very taciturn and became markedly pale. He continued in this condition until he went South, his urine still remaining albuminous. After some weeks he returned, when his mind suddenly cleared up on development of bilateral pleurisy with effusion. In time he recovered completely from this, so that he was able to return to his business as if nothing had happened, and in the course of two years he married again and lived for a number of years afterward without any kidney symptoms. This case illustrates how varied the uremic conditions may be.

In other cases, notably in chronic interstitial nephritis, melancholia may develop with suicidal tendencies. These cases are apt to have high-tension pulse and should be treated accordingly.

At other times epileptiform convulsions set in often without antecedent symptoms, though usually with headache. The convulsions are so much like epilepsy that even cases of Jacksonian localized convulsions have been reported. In some cases the subsequent coma becomes more and more profound until it ends in death. In some instances when a patient comes out of a convulsion he is blind, which fact settles its uremic character. Uremic amaurosis ordinarily passes off within a few hours or a few days, and it is remarkable that it is not accompanied by changes in the retina. Typical delusional insanity, often with ideas of persecution, may last for a number of weeks.

After a convulsion it is not uncommon for various monoplegias in the arm or leg to be present, or even hemiplegias, which, on account of their toxic origin, leave no traces in the brain. Uremic dyspnea is very apt to assume all the characters of asthma, and the physician

when called to such a case should be on his guard, for, if the patient is past middle life, and has never had attacks of asthma before, this attack is very likely uremic. At other times the breathing may be hurried and then subside, to come on again a short time afterward. Another form occurs in attacks of Cheyne-Stokes respiration, which recurs at intervals for long periods of time.

Of the *circulatory symptoms* we may have violent palpitation of the heart, during which the pulse becomes very irregular. Another symptom is hiccup, which may be distressing and tormenting to the patient for days and nights together. At all times, when the symptoms of uremic dyspnea are present, the physician should be on the lookout for the supervention of fatal pulmonary edema, or effusion into the serous sacs, both in the pleura and the pericardium. It should be mentioned, however, that, though the attacks may take the form of pericarditis or of pleuritis, there is much more effusion into these serous sacs than pain. So often are the attacks painless that they may be overlooked altogether.

The *gastro-intestinal symptoms* are also very characteristic, the commonest being uncontrollable vomiting, associated with great nausea, the patients often objecting to the very sight of food. Sometimes nothing will control the vomiting, and the patients apparently die from it. Not uncommonly the vomiting is accompanied by obstinate diarrhea. This diarrhea may become chronic and characterized by the formation of extensive diphtheric exudations in the colon, when the patients may pass long flakes of those exudates. Both the vomiting and the diarrhea are accompanied by great general prostration. In all these conditions of uremia a striking symptom is a very staring expression of the eyes, due to a virtual paralysis of the iris. In health the expression of the eyes is often very striking in showing passing conditions of emotion, all caused by rapid changes in the iris. So accustomed do we become to this ocular phenomena, that we are sure to note the fixed condition in uremia from the eye appearing so staring. This staring expression has of itself often led me to suspect uremia when I first have seen a patient with it, for it is not likely to be present in any other condition, except in some cases of chlorosis.

Treatment.—The treatment of uremia when the diagnosis is once settled should be the treatment of the particular form of kidney disease upon which it depends. Thus, uremia developing in a child with scarlatinal nephritis differs materially from the treatment of uremia supervening in an adult with chronic interstitial nephritis.

NEPHROLITHIASIS (OXALURIA)

While the clinical symptoms of gravel or of stone in the kidney are usually very distinctive, there is no subject in biochemistry which is more often discussed, without satisfactory explanation, than the various disorders due to uric acid in the blood or in the urinary passages. This is illustrated in discussions upon the origin of those so-called purin bodies which are antecedents in the metabolism of urea and of uric acid. It is there often stated that uric acid is a less oxidized product than that very soluble urea, which is the chief final element in us of nitrogenous metabolism. But, if so, it is difficult to account for the fact that birds habitually excrete uric acid instead of urea, while birds take in proportionately more oxygen in their breathing than we ever do.

In normal human urine uric acid is always present, but in a minute fraction, the average proportion of uric acid, as compared to urea, being 1 to 50.

Uric acid is present in excess in the blood in all gouty conditions, where it combines with soda to form the insoluble biurate. It requires, however, some other element to be present to cause uric acid to be formed as an insoluble precipitate in the kidney or urinary passages so as to occasion attacks of gravel or of kidney colic. These calculi, in fact, are composed chiefly of pure uric acid, and the conditions of their formation are clinically well marked; one of them being that the urine itself should be highly acid. Taking food, particularly much vegetable food, causes at first alkalinity of the urine, but, as time elapses, the urine begins to be acid, and in four or five hours afterward still more so. It is the rule, therefore, that uric acid is precipitated by very acid urine, so that the first attacks of gravel or of kidney colic usually come on after midnight. Commonly, when these attacks are habitual, the patient complains of dull aching in the back, which may continue for a long while, until a paroxysm of pain sets in with great severity; the pain radiating down the groin, usually on one side, on the inside of the thigh, and in the testicle on that side.

If a calculus is formed in the kidney, and becomes dislodged so as to enter the ureter, the pain there presents all the characters of a stretching pain which we have described, accompanied by nausea or vomiting with a sense of fainting, and not uncommonly with a cold perspiration, which continues until the calculus has dropped into the bladder. Sometimes these renal calculi are so large that they remain in the kidney for years, producing constant backache, accompanied frequently by hematuria. In such cases the diagnosis may become

settled by an x -ray picture, the taking of which has recently been so much improved that this procedure should never be omitted in obscure cases. If, instead of one large calculus, the case is one of gravel, minute crystals may then be found in the urine which are visible to the naked eye. Not uncommonly a calculus grows in the bladder by accretion of such crystals until a real stone is formed, which causes cystitis and a frequent desire to pass water, and severe pain at the neck of the bladder with pain referred to the head of the penis.

Unlike so-called gall-stones, calculi in the bladder are real stones and cannot be dissolved, and hence can be gotten rid of only by operations. A great deal, however, can be accomplished in the way of prophylaxis. Persons who are subject to attacks of gravel should take $\frac{1}{2}$ dram of citrate of potash an hour after each meal and a full dram on going to bed. For the resulting inflammatory state of the urinary passages a prescription of the fluidextract of buchu with liquor potassium (see Pyelitis) will be of great service, while the diet should be regulated by abstaining from the red meats and from sweet-breads, as well as from fermented liquors of all kinds, whether wines or beers. These patients should partake freely of water; if not, a mild alkaline, like Vichy.

Some calculi which cause the greatest pain in passing are composed of oxalate of lime, which form such jagged concretions that the edges irritate the urinary passages. Such patients should carefully avoid taking asparagus, and should resort to a mercurial purge once or twice a week.

We may have phosphatic calculi form in the bladder from the opposite condition of alkaline urine, giving rise to phosphatic deposits, already referred to under the heading of Phosphaturia. These calculi are formed usually of calcium phosphate and ammonium magnesium phosphate. These may grow into the largest calculi that are found in the bladder, having frequently begun with a nucleus of uric acid, and which can be got rid of only by operation.

Other conditions of the urine are also common. Stones composed of uric acid and urate are common at both periods of life, among children and persons above fifty. It is difficult to account for their frequency in children, unless it be from a greater tendency to a formation of high acid urine then, which diminishes afterward under a mixed diet. The calculi composed of an oxalate of lime are often dark in color and are very hard. Bacteria are sometimes found as if they were a nucleus around which the uric-acid crystals are collected. This

would be analogous to the formation of many gall-stones, of which masses of the *Bacillus coli* are so often the beginning. When calculi are numerous in the pelvis of the kidney they not uncommonly produce pyuria as well as hematuria.

Uric acid occurs in the urine in combination with ammonium and sodium, forming the acid urates. These urates may be held in solution while the urine is warm, but are deposited in the vessel as soon as it cools, forming what is called the brick-dust deposit, in which it is important to remember that the uric acid itself may not be in excess, but only its salts. As a rule, however, the habitual occurrence of brick-dust sediment should lead to the administration of mild alkalis, like the citrate of potash, 20 or 30 gr., three times a day. It is not uncommon in such cases to have attacks of lumbago supervene, which should always be treated by administrations of mercurial laxatives, such as a 5-gr. blue pill, to be followed by a mineral water, such as the Pluto water, repeated every other night in obstinate cases.

As uric-acid concretions are the commonest causes of urinary gravel it is well to note that, although common in gouty persons, many patients with pronounced gout are never troubled with uric-acid concretions of calculi in either kidney or bladder. There must, therefore, be some special element or enzyme present in these patients to render them subject to such disorders.

CYSTITIS

Disorders of the urinary passages which remain for our consideration are cystitis, prostatitis, and urethritis. Cystitis is an inflammation of the mucous membrane of the urinary bladder, and is generally due to the invasion of the bladder by micro-organisms. Hence, it very often follows catheterization by which various micro-organisms are introduced. A common cause is due to the extension backward of urethritis produced by gonorrhea. In elderly persons it may be caused by the loss of tone, produced by overdistention of the bladder following the obstruction by an enlarged prostate, and it also is often caused by the presence of calculi. The symptoms of acute cystitis are pain, referred to the region of the bladder in front, and in some cases to the perineum. Along with the pain is a very frequent desire to pass water, which may interfere with the sleep of the patient. In addition to the causes enumerated, the bladder is sometimes invaded by the tubercle bacilli, which produce very obstinate disorders of the organ and quite commonly hemorrhage. This infection is frequently a result of tuberculous kidney. The urine contains a large

amount of pus, and, in chronic cases, this may produce a ropy sediment, with accompanying ammoniacal decomposition of the urine and an abundant formation of crystals of triple phosphate. When a cystitis is caused by one or more calculi in the bladder the pain is much aggravated at the end of the act of micturition. The pain may then be very characteristically referred to the head of the penis.

Treatment.—In all cases of chronic cystitis no measure is so effectual as washing out the bladder. This should be done by first injecting not more than an ounce at a time of the saturated solution of borax, preferably by a Politzer bag holding 8 oz. So soon as it is estimated that 1 oz. has been injected, the stop-cock of the bag should be turned, and the water allowed to run out of the catheter, and then the same procedure repeated until the return water runs clear. No more than 1 oz. should be injected at a time, because it should be remembered that the bladder has to relax very slowly in health, and serious injury has been produced by trying to inject even 2 oz. at once. Many authors recommend, after the bladder has been washed out, the use of the solution of silver nitrate in the proportion of 1 : 8000 to 1 : 3000. When the bladder seems to be washed clean of mucus, 1 oz. of the solution, to which 1 to 3 gr. of resorcin have been added, should be injected to remain in the bladder, the resorcin being the best agent that I know of for preventing fermentation.

PYELITIS, OR INFECTION OF THE Pelves OF THE KIDNEY

Pyelitis may become one of the most serious of conditions, because it is due to both primary and secondary infection by micro-organisms. The secondary infections are usually of an ascending character from an inflamed bladder, notably in the chronic cystitis of elderly patients with enlarged prostate. It should always be remembered that an enlarged prostate threatens the patient not only with cystitis, but with consequent ascending infection of the kidneys through the ureter, which then first develops a pyelitis, and, according to the virulence of the infecting micro-organisms, spreads through the calices and between the pyramids to the whole organ, inducing in many cases a true pyonephrosis, with possibly a destruction of the kidney, forming a well-defined tumor in the flank. Catheterization, which is often so necessary in cases of urinary obstruction and cystitis from enlarged prostate, is of itself a constant source of infection by micro-organisms, especially if the catheters have not been properly washed and cleansed in aseptic fluids before their introduction. It is impossible to ster-

ilize the urethra, and hence catheterization is almost certain, sooner or later, to cause infection of the urinary passages.

Direct inflammation of the pelves of the kidney may occur from the presence of gravel and render them more susceptible to infection. The commonest micro-organism for inducing pyelitis is the *Bacillus coli*, as we have already explained, for this may reach the kidney both directly from the blood and also by the root of the bladder. Next to the *Bacillus coli* in frequency is the tubercle bacillus, which may reach the kidney by the same variety of sources as tuberculosis elsewhere, but is often in the early stages most evident in developing about the calices of the pelvis. In tubercular kidneys there is a special tendency to hemorrhage or to hematuria, with the extension of the ulceration subsequently to the whole organ, and leading to the formation of small abscesses, owing to the very common association of the pus organisms with the tubercle bacillus.

It is important to recognize the presence of pyelitis as early as possible, because in many cases its forms are quite amenable to medicinal treatment when taken in their earlier stages. On the discovery of the pus in the urine it should be determined whether it comes from the bladder, or whether from the ureter, and for this purpose the cystoscope should be used to test which ureter is involved. Pyelitis is infrequently caused by the administration of turpentine or cantharides or similar irritating agents, and will soon subside on their withdrawal.

Treatment.—Pyelitis, as we have seen, is a progressive disease, which, beginning in the pelvis of the kidney, may extend so as to involve and destroy the whole organ. It commonly affects only one kidney, and hence its early recognition is most important, for in its beginning it is quite amenable to medical treatment, because various agents are readily excreted by this organ, and thus act more locally than, for example, in the case of the lungs or even of the intestinal tract.

I have found the fluidextract of buchu one of the best sedatives for inflammatory conditions of the urinary tract, in doses of a dram, to which $\frac{1}{2}$ dram of liquor potassæ may be added if the urine is acid. In pyelitis I always add a teaspoonful of paregoric, because I have found this an admirable adjunct as well as a local antiseptic in these cases. This prescription may be given every three hours, or oftener, in severe cases.

I once cured an aggravated case of tuberculous kidney, accompanied both by hematuria and pyuria, with abundant presence of tubercle bacilli, but no cystitis, by the above prescription of buchu

and paregoric, on account of kidney pain, and the administration of 15 gr. of creosote carbonate in emulsion every three hours till the urine was darkened by it. The pain and fever subsided in two months, and the tubercle bacilli disappeared after three months, though the treatment was kept up for a year, when the patient wholly recovered, and, at last accounts, was well twelve years after the original attack.

Urotropin, as might be expected, is also an efficient remedy in such cases. I have not found the large doses sometimes recommended advisable, because this drug, by itself, occasionally causes much local irritation. This can be obviated by the simultaneous administration of sodium benzoate, as mentioned in the treatment of kidney and bladder infection by the *Bacillus coli*. For this, as then stated, 10-gr. doses of urotropin, with the same of sodium benzoate, every three hours will suffice.

HYDRONEPHROSIS

In whatever way an obstruction occurs in a ureter the secretion of the kidney accumulates behind it, with resulting changes, varying according to the nature of the obstruction. Thus, a movable kidney may cause a sac to be formed large enough to appear as a tumor, which then disappears, with a sudden flow of urine, only to reaccumulate again and then similarly disappear. In some cases this process may go on for years. In these intermittent cases the sac may in time become very large, and so fill the abdominal cavity as to be mistaken for ascites.

When the obstruction cannot be removed, as from an impacted calculus, the pelvis of the ureter is first dilated and then general dilatation of the kidney follows, turning it into a cyst, with little trace of kidney tissue remaining. As this is an acute process it is accompanied by much pain and fever, but not with the uremic symptoms, because the other kidney takes up all the duties of its fellow, as in the case mentioned on page 426. Large sacs may be confounded with ovarian tumors, and aspiration of the fluid may be necessary to settle the diagnosis, the puncture being made in the flank, between the ilium and the last rib.

Occasionally hydronephrosis is caused by pressure on the ureter from without, particularly by cancers of the uterus or ovaries. In some cases hydronephrosis is of antenatal origin, the destruction of the ureter being due to various malpositions of the pelvic viscera. The resulting tumor may be so large as to retard labor. Surgical draining of the recurrent tumor is the only recourse in such cases.

PERINEPHRIC ABSCESS

No illustration could be better of the difference in the body between an accumulation of watery fluid and a collection of pus. This is demonstrated in the contrast between the mere water collection, such as that of hydronephrosis, just spoken of, and a perinephric abscess. A watery accumulation can do no harm, except occasionally by mere mechanical pressure, but a collection of pus may be as deadly in its results as an explosion of dynamite. Thus, in contrast with the hydronephrosis, a perinephric abscess may make its way up to the pleura and chest into the lung; or, more frequently, it may pass down the psoas muscle and appear in the groin; or it may pass along the iliacus fascia and appear at Poupart's ligament; or it may perforate the bowel; or it may break into the peritoneum; or it may perforate the bladder, or break through the vagina.

Consequently, the symptoms may be very varied and widespread, owing, for example, to pain referred to the hip, and radiate down the inside of the thigh and cause retraction and pain in the testicle on that side. If the patient attempts to walk he has much difficulty in voluntarily adducting the thigh; he also keeps the spine immobile and assumes a stooping posture, and, when lying in bed, he has to draw up one leg to relieve tension upon the psoas muscle. From proximity of the pus to the large intestine it may become very offensive in its odor.

These clinical facts are all explicable by the relation of the kidney to the surrounding parts, because this organ lies in an extensive mesh of connective tissue, in which collections of pus are very loosely held, and, on slight provocation, may travel in any direction, with the results as described. It is important, therefore, that this condition be early recognized, and one very suggestive sign is the supervention of hyperleukocytosis in the blood. Whenever a swelling in the region of the kidney is accompanied by chills and fever the presence of a hyperleukocytosis is a proof of the development of an abscess in that region.

The formation of a perinephric abscess may result from a number of different causes; thus, a common cause is from blows or injuries in that region, or the extension of inflammation from the pelvis of the kidney, the kidney itself, or the ureters, or from perforation of the bowels in appendicitis, or extension of suppuration from the spine in caries; in tuberculous disease of the vertebræ, but occasionally it occurs from extension of an empyema in the pleura, or it may be a sequel in children to infective fevers.

On examining in the region of the kidney, a swelling, often with a

sense of fluctuation, may be found between the last rib and the crest of the ilium. The only doubt likely to occur in diagnosis, especially in children, may be that it is due to disease of the hip-joint, but the pain and other symptoms are located above the hip, and none of the distinctive signs of hip-joint disease are present.

The **treatment** of these cases is always surgical, because the indication to drain the pus without delay is imperative.

MORBID CONDITIONS OF THE URINE

Indicanuria.—In this section we do not include subjects treated elsewhere, such as glycosuria, albuminuria, pyuria, and hematuria.

The first of these subjects is indicanuria. This designates the presence of indican in the urine, as demonstrated by reaction with the formation of indigo, on using Jaffé's, Obermeyer's, or similar tests.

Indol is absorbed from the intestines, and forms in the liver indoxyl potassium sulphate or indican, an ethereal sulphate which is eliminated in the urine. This is a common and always significant condition, due to abnormal putrefaction in the intestines. Progress in our knowledge of processes of intestinal digestion has shown that many serious disorders proceed from this cause, one of which is revealed by an excess of indican in the urine. Thus, when we investigate the steps which lead up to chronic interstitial nephritis, and then to the development of arteriosclerosis with all its attendant evils, we find, as already mentioned in the discussion of kidney diseases, that such affections proceed from chronic intestinal disorders. Prominent among these intestinal disorders, which are the precursors of diseases of the kidneys, we must now assign an important place to chronic indicanuria.

The *causes* of indicanuria, though numerous, may yet be grouped together as due to faulty digestion of the nitrogenous or protein articles of food. An excess of meat diet, for example, is one of the causes of indicanuria, and this is commonly accompanied by constipation. Thus, carnivora have much less bulky movements of the bowels and less frequent than herbivora, but, as we have already mentioned, an excess of indican, besides leading to disorders of the kidneys, also predisposes, by absorption of poison from the intestines, to convulsive nervous disorders. Hence, carnivora usually die in convulsions, while these are uncommon among herbivora.

Treatment.—In the article on the Treatment of Epilepsy I strongly condemned the use of a hearty meat diet in that disease and excluded all butcher meats in such patients. Indicanuria, therefore, should not be lightly regarded, and its presence should receive the serious consider-

ation of every physician, so as to lead promptly to its removal by treatment, if only for prophylaxis. This indication is first met by regulating the diet, for, both in these cases and those of chronic nephritis, red meats should be excluded, and fermented milk, with fruits and vegetables, taken instead.

We have long been desirous for a better knowledge of the morbid processes which precede the slow development of interstitial nephritis, along with it the supervention of arteriosclerosis, not in one part of the body only, but all over the system. It now seems almost demonstrated that chronic intestinal disorders are responsible for the development of both these general systemic conditions, and that these in turn are due to that blood-poisoning which is shown by excessive indican in the urine.

We have also in urotropin an effective remedy against indicanuria, using 10 gr. of urotropin and 10 gr. of sodium benzoate, taken in the form of powders, an hour after meals and at night. Some cases of severe vomiting, occurring at intervals in connection with high arterial pressure, can be stopped only by prompt medication. Cases are reported (Kemp) in which double these doses of urotropin proved to be the only way of checking this complication.

Lithuria.—This condition of the urine we have already spoken of in disorders of the kidneys accompanied by excess of uric acid or gravel, to which the reader is referred.

Phosphaturia.—Excess of the earthy phosphates in the urine may be detected only by boiling it, when a cloud forms that seems like coagulated albumin in the excretion. That this appearance is due not to the presence of albumin, but to excess of phosphates, is shown at once by adding 1 or 2 drops of strong nitric acid, when the fluid at once clears up. In some cases of phosphaturia, however, the urine when passed is actually milky in color; the reaction as tested by litmus-paper may be either neutral or actually alkaline and of low specific gravity. Phosphaturia is indicative of much nervous depression on the part of the patients, and is best treated by taking an alcoholic drink, though always with meals.

Chyluria.—I once had a patient at the Roosevelt Hospital who passed a very milky looking urine. I accordingly had his blood examined in the evening, and found in it the characteristic ova nematoid worm called the *Filaria Bancrofti*. When the same blood was examined at 10 o'clock the next morning no ova were found, and so repeatedly afterward such examination would detect the nematoid's products only at night, but not during the day. This case sufficiently

illustrates the peculiar characteristics of this infection, which is rare in our country excepting in our Southern States, but is very common in tropical countries, as in British Guiana, where it is said that 58 per cent. of the people are so affected. It is now plainly demonstrated that the mosquito first sucks blood infected by this parasite and then transmits it to others, just in the way malarial organisms are propagated. Like the malarial organism also the blood may remain infected by this method for years, and yet without the general health being much impaired. It is curious that this organism spreads through the system only during sleep, for if the patients' habits of sleep be reversed so that they sleep in the daytime the filaria, instead of charging the blood at night, do so only during the day.

These organisms may produce their effects mainly by blocking the lymphatics of the scrotum, so that it becomes enormously swollen. They are also charged with producing what is called elephantiasis of the legs, a condition found in tropical countries, of which I have seen two marked examples. It is strange, however, that in neither of these conditions were there any other morbid symptoms.

The adult male measures 83 mm. long by 0.407 mm. broad; the tail forms two turns of a spiral. The adult female measures 155 mm. long by 0.715 mm. broad; vulva 2.56 mm. from anterior extremity; eggs 38 by 14 mm. It is this species to which both chyluria and elephantiasis are ascribed.

Chyluria, on examination, shows not uncommonly a good many blood-corpuscles suspended in a fluid, whose milkiness is due to minute globules of fat.

My own belief is that the blood can be freed of this parasite by the free administration of urotropin with sodium benzoate, from 40 to 80 gr. of each a day. Abstinence from all fat in the diet often causes the disappearance of chyluria, but not the cure of the disease. Some surgeons report favorable results from excision of the enlarged lymphatic glands in the groin.

Some very rare cases are reported which are not due to parasites, but their nature is doubtful.

Cystinuria.—Cystin is one of the unusual products of protein metabolism which may be excreted by the kidneys and even form calculi. This faulty metabolism generally occurs as a family complaint, which, in minor degree, may exist without disturbing the general health. These calculi are formed of crystals, colorless and hexagonal, and are readily detected, and, as their cause is unknown, their treatment, when they form calculi, must be surgical.

Melanuria, or black urine, may have a very serious import when caused by the disintegration of melanotic sarcomatous tumors in the body. In some cases this pigment is lodged in the subcutaneous tissues, of which I have seen several examples. In other cases the urine becomes dark or smoky from blood in the urine, and also to a small degree in hemoglobinuria. The commonest cause, however, of such darkening is from drugs. Thus carbolic acid may cause it and a great many of the derivatives of the coal-tar series, such as creosotal, sulphonal, and similar substances, when they are, however, of but slight significance.

Bacterinuria.—The commonest examples of these conditions of the urine we have already referred to in our article on the Infections by the *Bacillus Coli*, in which we described the hazy appearance of the urine due to the excretion into it of immense numbers of this bacterium, and which may occur, either primarily or secondarily to absorption of these bacteria, from ulceration of the intestine in typhoid fever, the treatment for which may be found in that article.

TUMORS OF THE KIDNEY

The kidneys, like other abdominal organs, may be invaded by malignant growths, either cancerous or sarcomatous. The commonest condition is that of invasion from without, and, if the patient is a child, it is almost certainly a sarcoma. When small, the whole tumor may be movable and the diagnosis relatively easy, because the colon lies in front. When it is large, however, adhesions are common, and then the diagnosis may be quite difficult. Occurrence of profuse hematuria along with a tumor in either flank is decisive of the malignant character of the growth. In other cases the diagnosis may be cleared by an *x*-ray picture, showing the relative positions of the parts. If, in addition to this, constitutional symptoms are present, such as progressive emaciation, there can be little doubt of the malignant nature of the growth.

Benign growths develop in the kidneys, usually small nodular fibromata, occurring about the pyramids.

CYSTS OF THE KIDNEY

Occasionally, though rarely, hydatids form cysts in the kidney, as already mentioned in our article on Hydatid Disease. But the commonest form is polycystic condition of the kidney, usually bilateral, in which the kidneys are very much enlarged, and are found after death to contain hundreds of small cysts, the origin of which is much

disputed; the most probable view is that they are due to congenital faults in development, because such cystic kidneys are found to precede birth, when nearly the whole abdominal cavity is so occupied by the tumor as to obstruct labor.

I once saw, at postmortem, the kidney transformed into masses not unlike a large bunch of grapes.

MOVABLE KIDNEY

Some years ago we used to hear much about the various troubles occasioned by movable kidney, and many symptoms were associated with such displacements. We hear less about them now, but they undoubtedly do occur, for every practitioner is apt to find one kidney at a considerable distance from its right place and at the same time very movable. It is well not to tell the patient about such abnormalities, because they may go through life without suffering any inconvenience from them.

Displacement of the kidney frequently coexists with the falling down of the abdominal organs or gastropptosis, called Glénard's disease. But there can be no doubt that such displacements may sometimes produce severe symptoms, described as Dietl's crises, which are best explained by kinks in the ureter leading from the displaced kidney. These attacks are characterized by severe pain, accompanied by nausea and sometimes by vomiting, and which are finally cured only by stitching the displaced kidney to the abdominal wall. Previous to this the trouble may be wholly relieved by Rose's belt for gastropptosis, as previously described, or by using, if properly applied, an abdominal supporter.

Displacement of the kidney is apt to occur where the abdominal walls are left lax and pendent after repeated pregnancies. They are more common on the right side, as the kidney there lies directly under the liver. The diagnosis is usually easy by having the patient lie on the back with the knees drawn up, so as to relax the walls of the abdomen, and, with one hand under the ribs behind and the other in front, when, by palpation on the under surface of the liver, the lower part of the kidney may be easily felt, particularly on deep inspiration.

In conditions of true movable kidney the whole organ may thus be made palpable.

CHAPTER XI

DISEASES OF METABOLISM

GOUT

CLINICAL facts furnish much more trustworthy information than any chemical theories about the nature of gout. Thus, there has been a great deal written about the metabolism of the so-called purin bodies—adenin, guanin, hypoxanthin, xanthin, and uric acid—resulting from the transformation of the nucleoproteins of the food and of the tissues, but against these stands the fact that gout is unknown in countries where no fermented liquors are used. It is, therefore, not alcohol which causes gout, because in countries which are noted for excess in the use of spirituous liquors every disease which alcohol produces is sure to be common except gout. Thus, in England it may be termed “pandemic,” on account of the historic as well as present consumption there of beers and ales, but, on crossing the Tweed into Scotland, we find whisky to be a universal drink, without its giving rise to gout. In America gout used to be quite an aristocratic disease and complacently referred to by its victims as a sign of their taking high priced Port or Madeira wines, otherwise whisky was the American drink. On the introduction, however, of lager beer into the United States gout became a very plebeian affection, though it is yet practically unknown in those parts of the country which consume only whisky. Previous to the introduction of lager beer gout was prevalent in this country only among those who drank one of the most potent agents for its production—namely, cider.

The word “metabolism” covers a multitude of unknown things. That fermented liquors should cause gout and distilled liquors do not confirms the statement of Sir A. Garrod, that if there were no fermented liquors there would not be any gout. This clinical fact cannot be accounted for by the chemistry of uric acid. Moreover, all diseases accompanied by an excess of white corpuscles, as in leukemia, show a corresponding increase in uric acid, but without producing gout. Chemically speaking, the insoluble uric acid should be oxidized into the soluble urea, but in birds, whose respiration is so active that they should oxidize without limit, nevertheless they excrete not urea, but uric acid. It is medical experience which shows that in gouty persons there is an excess of uric acid in the blood, and, as the blood must be

alkaline, this acid combines with the soda there in the form of the biurate of soda.

Gout, however, furnishes a strong argument against Weismann's theory that acquired systematic habits are not transmitted, for it is notorious that gout, once acquired, is very apt to pass on and become a hereditary disease in the descendants, though more apt to be transmitted through the female line than through the male. Thus, a man may inherit gout from his grandfather through his grandmother, who herself did not suffer from the disease.

The biurate salt, however, is insoluble, and clinically causes gouty arthritis in its own particular way. Thus, at first it has no resemblance to rheumatic arthritis in the joints which are affected by it. As all inflammations of joints produce very much the same symptoms, so a rheumatic arthritis and a gouty arthritis are often confounded, but the clinical histories of the cases differ characteristically. Rheumatic arthritis is polyarticular from the beginning, and, though it may begin in the feet, it is sure to attack the joints of the upper extremities as well, such as the fingers, wrists, and shoulders. Gouty arthritis, on the other hand, is at first monarticular, developing most commonly in the great toe, and it may remain for several years, attacking the lower extremities. Once, however, it involves the knee, it then becomes distributed over all the joints, with the exception of the jaw and the sterno-articular joints.

There are, however, many peculiarities presented by gouty arthritis. The skin over the joints also becomes inflamed, so that on the subsidence of the inflammation it peels, which it never does with a rheumatic inflammation. It should be remembered that a rheumatic inflammation, however severe or prolonged, does not permanently fetter the joints. The restoration of long-standing inability of the joints to be moved after rheumatic inflammations is always practicable by douching the joints with hot water and the simultaneous use of massage and movement. Gout, however, when it attacks a joint almost invariably leaves a deposit of sodium biurate in the cartilage or in the synovial sheaths, and a joint once distorted by gouty deposits cannot be restored.

When gouty inflammations are widely distributed it may be difficult to distinguish them from rheumatic arthritis, but I once drew attention to the marked difference in the painful points on pressure in the joints of the two affections. In gout the painful points are at the condyles of the knee, for example, and at the ends of the transverse diameter of the joints of the fingers, but in rheumatism the most pain is felt along the course of the tendons. Thus, in a gouty knee the pain-

ful points are at each condyle, while in a rheumatic knee it is above and below the patella. Similarly, these points differ in the fingers, where in rheumatism the pain on pressure is most pronounced along the tendons; in gout it is limited to the ends of the transverse diameters of the joints.

Gouty deposits are often diagnostic, as in those accretions found in the external ear, called tophi. These may be found there when no other deposits can be discovered in the body. Gouty deposits about a joint are often very general, beginning with the surfaces of the articular cartilage and then extending to the ligaments, fasciæ, tendons, and synovial membranes. In some cases they may involve the skin, which may ulcerate and leave the gouty deposits exposed.

Besides the articular affections, gout-like rheumatism may affect internal structures not connected with joints, but, though acute rheumatism seriously affects the heart, gout almost never does so as a primary affection. On the other hand, while rheumatism does not affect the kidneys, gout causes one of the most serious of all renal diseases.

When gouty kidneys are cut open gouty deposits of uratic matter are seen on the cut surfaces. In the cortical substance the deposit occurs as specks, scattered irregularly through the tissue, but in the pyramidal portion the matter is in strips, running in the direction of the tubuli. In both cases the deposit is situated in the intertubular substance, and, when examined under the microscope, is seen to consist of acicular crystals exactly resembling those found in gouty joints. The kidneys are granular, and closely resemble the conditions found in ordinary interstitial nephritis.

Besides these disorders there are many others, both functional and organic, which are classed under the head of irregular gout. Thus, we may have gouty ophthalmia, which may be controlled only by administering the specifics for gout.

Gouty bronchitis is one of the manifestations of irregular gout. Its onset may be very sudden. I was once called in at night to a lady whom I had long known as a victim of hereditary gout, when I found fine mucous râles over both lungs, and, in the course of two hours, she expectorated a large basinful of pinkish-colored mucus. This bronchitis often cannot be distinguished from ordinary chronic bronchitis, but the discovery of a gouty element in the case may hasten the recovery by adding to other remedies colchicum and potassium iodid. An attack of gouty arthritis may have many prodromata, the patient feels dyspeptic, and not uncommonly much depressed in spirits, and some persons are able to predict that they will have a joint develop-

ment in the course of a few days by the supervision of such symptoms, which all clear up after the onset of the arthritis. It is a curious fact which has long been observed that the output of uric acid diminishes during the intervals between attacks of gout, to return to normal, or excess of normal, immediately after a visit of gout.

Treatment.—The effective treatment of an attack of acute gout is the administration of the wine of the root or of the wine of the seeds of the meadow saffron, called colchicum, a native of Europe and of Asia. Colchicum is the only drug of vegetable origin which can produce permanent constitutional effects. (See Difference Between Functional and Constitutional Remedies in the chapter on Remedies.) An instance of this was related to me by Dr. Norwood, of Alabama, to whom the profession is indebted for the introduction of veratrum viride. He said that some young men in his neighborhood when on a lark broke into the office of a country practitioner while the doctor was away, and, after mixing up his drugs so that he could not use them, they drank to the doctor's health from a bottle which contained colchicum wine. It was not long before they were very anxious for the doctor's return. One of them died from the effects, while the others, after more than a week's illness, turned universally yellow, and lost every particle of hair on their bodies, including their eyebrows. This is very similar to the effect of the cobra venom, as I have personally seen in the East.

We have no means of judging how colchicum produces its effects any more than other alteratives. It is a virulent poison, which shows its effects by causing severe gastritis and enteritis, so that nothing will stay on the stomach, while the stools become bloody. It also causes great irritation of the kidneys. Death ensues from heart failure.

In the treatment for an attack of acute gout by colchicum the drug should be administered in doses of from 15 to 20 drops of the wine of colchicum seed, with slightly lower doses of the wine of colchicum root, given every two or three hours. As a rule, the severity of the arthritic pains and swelling subsides, a result which no other known drug can secure. It does not show the same effects in chronic or irregular gout, but may be used whenever this form of gout takes on acute development. I have not found this medicine to be efficacious when it loosens the bowels, and prescribe from 1 to 2 drams of paregoric to prevent this action. In chronic gout the action of colchicum is promoted by the simultaneous administration of 2 gr. of quinin six times a day, or of 10 to 15 gr. of phenacetin. There can be no doubt that many patients are also helped by the simultaneous administration of small doses of 3 to 5 gr. of potassium iodid, while others are still more benefited by the administration of small doses of arsenic, either

in 3- to 4-drop doses of Fowler's solution, or $\frac{1}{4}$ gr. of the arsenite of soda. Some authors recommend that gout is benefited by diminishing the intake of common salt.

There is a nostrum called Laville's extract, which I have often found successful when other remedies have failed; the active principle of this preparation is undoubtedly colchicein, combined with various vegetable substances. I have prescribed it in doses of a dram of Laville's extract with a dram of the elixir of cinchona, in doses of from 1 to 2 teaspoonfuls twice a day, and have found this beneficial in chronic gout when colchicum itself had failed.

DIABETES MELLITUS

The subject of gout introduced us to the wide subject of metabolism. But gout is nothing compared with diabetes in doing the same thing. More than fifty years ago Dr. J. B. Dalton, in the preface to his then leading book on physiology, stated that the recent discovery, by Claude Bernard in 1857, of the glycogenic function of the liver promised to reveal the true nature of diabetes. Since that time many facts relating to this subject have been discovered, but diabetes mellitus itself remains as great a mystery as ever. We hear of bread being the staff of life, but to a diabetic bread is a deadly poison. This only illustrates what a calamity it is to suffer from diabetes, because so far true diabetes is incurable, and its doom is death.

This statement becomes natural when we recognize what the fundamental facts about diabetes are. The muscles are the furnaces of the body, supplying to it both heat and power. The blood in the veins flowing from a large muscle, like the gluteus maximus, is much more venous in its character, though the muscle be at rest, than the blood in the right chamber of the heart. This shows how much of something has been burned up in the muscle while the blood was coursing through it. That something, we now know, is the carbohydrate in our food, composed of the starches, sugars, and fats. It is in the combustion of these elements of our food in the muscles that we find the source of the heat and of power which the body requires for its life, but in diabetes the muscular tissues do not sufficiently burn up the carbohydrates. These have been before properly changed into the most easily consumed of carbohydrates—viz., sugar—and as the muscles fail to oxidize it the sugar accumulates in the blood until it is beyond what the blood can carry—viz., .15 per cent. All above this has to be got rid of by the kidneys, causing glycosuria or sweet-tasting urine. Glycosuria is, therefore, the first sign of diabetes, and, when it is found, no one can be sure whether it will go on to full diabetes or

not. Often glycosuria can be made to disappear, either by lessening the intake of carbohydrates or by drugs, so that some speak lightly of the appearance of sugar in the urine as not itself of much importance. One might as well say that fever is a trivial sign, because it is so often transient and moderate in degree. The presence of glycosuria is always a danger-signal.

The carbohydrates never make tissue, but, on the other hand, they have to go through various processes before they can be burned up. The first is their conversion into glycogen, in which form they are stored up in the liver and also in the muscles. The storage of glycogen in the liver is estimated as one-tenth its weight. Bernard, on its first discovery by him, correctly said that the final change of glycogen is for fuel in the muscles.

We have said that various processes of preparation are necessary for the glycogen to be burned up by the muscles; the principal of these preparatory processes is by the action of the internal secretion of the ductless glands, the deficiency of which will suffice to cause the sugars to escape combustion and thus to produce glycosuria. The most striking illustration of this is furnished by the glands embedded in the substance of the pancreas, called islands of Langerhans. These glands have nothing to do with the functions of the pancreas itself. Their relations instead are with the metabolism of the carbohydrates, and it is not owing to the mere quantity of their secretions that their specific effect is produced, for if only a few of these glands in the tail of the pancreas remain when the pancreas itself has been cut away those few glands answer all the purposes of preventing glycosuria. Moreover, it has been shown by experiments on dogs that, if the pancreas be removed entirely and a small portion of the pancreas of another dog be engrafted in the course of the portal circulation, this, in turn, will prevent the development of glycosuria. This clearly proves that all the islands of Langerhans do is to produce an enzyme, however minute in quantity, which will answer all the purposes, just as a single match will set fire to a large accumulation of combustibles. Cases, however, do occur in which the fuel is not combustible, and then it would be useless to apply any number of matches to start the fire.

What would seem at first sight to establish the essential relation of diabetes to these bodies in the pancreas is that they are often found diseased throughout in persons who have died from this affection. But in this tantalizing disease, as it has been well termed, cases have been reported in whom the islands of Langerhans were found quite normal, thus showing that diabetes may destroy life without affecting the pancreas at all.

The secretion of other ductless glands can also bear the same relation to the metabolism of the carbohydrates. This is shown in that most remarkable organ in the body, the pituitary gland, called also the hypophysis. This small body, which weighs altogether only about 5 gr., is located in the most inaccessible part of the skull, the sella turcica, and yet, notwithstanding its small size, it bears important relations to the nutrition of the body, shown in the hypertrophy of the bones of the extremities and of the face in acromegaly. Injuries to the base of the skull are often followed by glycosuria, which may also appear when a tumor is growing in the neighborhood of this gland and irritating it. Should the tumor, however, destroy the gland, we then find the opposite of glycosuria developing, for the patient can now show great tolerance for sugars, and, along with this, a marked increase in the fat all over the body.

Glycosuria or true diabetes may also develop in diseases of that other ductless gland, the thyroid, and then soon prove fatal. It has long been known, however, that the ductless glands are all associated in their functions, so that they are found to be enlarged or diseased in common in the same person. As to the relation of the ductless glands to the production of diabetes there is little doubt that it is the same as that which we have described in connection with the islands of Langerhans—viz., that their functions, though necessary, are simply preparatory to the ultimate use of the carbohydrates by the muscles. The conclusion, therefore, is that diabetes is primarily a muscular disease, but how it is so is yet unknown.

Claude Bernard demonstrated that there is a center in the medulla, puncture of which causes an increased percentage of sugar in the blood of the hepatic vein. He demonstrated that the efferent path of this influence was in the splanchnic nerves and the afferent in the vagi. There can be no doubt that the nervous system has much influence on liver metabolism, but the mechanism of this action is unknown, like many other problems in diabetes. I had a close friend, in whom fatal diabetes followed upon a long mental strain during a painful crisis of his life, with no other cause for his disease which was discoverable.

Diabetes goes by contraries. Ordinarily, youth is the age with the best outlook for the future, but in diabetes the prognosis is invariably worse the younger the patient, and steadily improves with advancing years. With young children it is soon fatal.

It is curious that, though the liver holds the greatest store of glycogen in the body, yet diabetes of hepatic origin is unknown. The liver may be damaged either by accident or disease, as in cirrhosis,

with no trace of consequent diabetes. The same is true of the kidneys.

Though the kidneys have so much work to do in the polyuria which carries off the sugar in the blood, yet diabetes itself is not associated with kidney disease. Men are more frequently affected with diabetes than women, the ratio being about 3 to 2. Diabetes is a disease of the higher classes. Von Noorden states that the statistics for London and Berlin show that the number of cases in the upper 10,000 exceeds that in the lower 10,000 inhabitants. As to race, Jews seem to be especially prone to it; one-fourth of Friedreich's patients were of this Semitic race. In my own experience, Hebrews are particularly prone to the disease, and in them women are, if anything, more subject to it than men.

In severe cases of diabetes the disease may go on, though all carbohydrates have been removed from the diet. The continuance of diabetes in them, however, is due to the destruction of the proteins in addition to the carbohydrates of the body itself. While this is occurring there is a marked increase in the urea eliminated from the body. I have been accustomed, therefore, to regard the percentage of urea as a good standard for estimating the gravity of the complaint. I have thought that I had reason to believe in the existence of a pure urea diabetes, and in a published paper I termed these patients cases of azoturia in which the urine showed a great excess of urea without the accompaniment of sugar. These patients are always of a neurotic temperament. One young man passed 1750 gr. of urea in a day. He had one brother who was insane and a sister who was both hysteric and abnormally fat. I have found that such patients respond favorably to the administration of intestinal antiseptics.

While there seems to be no difficulty in disposing of the proteins in diabetes, it is quite otherwise with the fats which are not sufficiently oxidized, the result being the formation of beta-oxybutyric acid in the blood, which is the immediate precursor of acetone and diacetic acid, the accumulation of which in the blood causes the fatal diabetic coma from actual acidosis. Efforts to counteract this acidity by large doses of sodium carbonate, whether by mouth or by the rectum or by intravenous injection, are almost universally unavailing.

The general lowering of the vitality caused by diabetes renders the body very susceptible to various infections; chief among them is the tubercle bacillus, which carries off a large number of diabetics. Thus, also the pneumonias of diabetics are prone to become caseous or else terminate in gangrene. Pus organisms also are apt to invade the

skin, particularly the *Staphylococcus pyogenes aureus*, which gives rise to numerous boils or large carbuncles. Every case of large carbuncle should have the urine examined for the presence of sugar. In many instances there is a great deal of itching of the skin, and in women obstinate irritation of the pudenda. This, in fact, may be the first indication of the presence of diabetes.

Symptoms.—Diabetes is usually insidious in its onset, the patient first noticing that he is passing more water and more frequently. Along with this he has often an abnormal appetite or a sense of hunger. After a time he further notices that he is more easily fatigued than is usual with him on exertion. Emaciation also, in a majority of cases, sets in soon after the polyuria. All along he is thirsty, and when the disease is fully established the thirst becomes specially distressing about two hours after meals. In addition, he becomes very nervous and frequently irritable or else melancholic. The skin is ordinarily dry and harsh, unless the patient is phthisical. One of the most striking symptoms is the appearance of the tongue, which has more than once suggested the disease to me. It is red all over, and has been called the beefy tongue. In advanced cases the breath has a sweet odor, and, in my experience, this symptom is of serious import. As a rule, the bowels are constipated. These patients are frequently depressed in spirits, and not uncommonly show peripheral neuritis, which usually is local, involving a nerve of the arm or occasionally the sciatic nerve. Cramps in the calves of the legs are very common, and lumbar pains, which may be mistaken for lumbago, the distinction being that the pains are not aggravated by bending of the spine, which they always are in lumbago. Along with the lumbar pains, particularly in elderly patients, there is complete absence of the knee-jerk. A number of reports have been published of postmortem examinations of the spinal cord, showing the degeneration of the posterior columns, similar to the findings in tabes.

Complications.—General bronchitis is always of serious import, and may be wholly independent of any infection, tuberculous or otherwise. Connected with the respiratory tract is a specific dyspnea, called by Kussmaul air-hunger. One form of this is quickly fatal, and is connected with fat embolism, caused by the presence of small particles of fat in the blood, which may even be accompanied by a creamy coat upon the blood-clot. The origin of this lipemia is quite obscure. Where the blood has been drained of its watery elements by excessive polyuria there may be an apparent great increase in the red corpuscles, amounting from between 7,000,000 and 8,000,000 to the

cubic millimeter. Notwithstanding this the intake of oxygen and the outgo of carbonic acid is diminished. As a rule, therefore, the temperature of the body is lowered to 96° or even 95° F. All vital functions are likewise depressed, presaging the end in diabetic coma. This may set in with varying antecedents, and the patient may suddenly complain of headache and become thick in his speech and staggering in his gait. Soon after he complains of great weakness, and may die in a few hours after an antecedent stuporous condition.

Our **treatment** of diabetes must be wholly empiric, owing to our ignorance of the pathology of the disease. Thus, as we have remarked, there is no accounting for the fact that the younger the patient the more hopeless the case, while the prospect becomes better and he becomes more amenable to treatment in proportion to his advancing years. Other facts also in the history of this complaint are equally inexplicable, which are reported by qualified medical observers from a number of sources.

Diet.—Osler ("The Principles and Practice of Medicine," 8th ed.) says: Keep the patient for three or four days on an ordinary diet which contains ordinary amounts of carbohydrates in order to ascertain the amount of sugar excretion. For two days more the starches are gradually cut off. He is then placed on the following non-carbohydrate diet, modified in each case according to the patient's age and weight, and arranged from a list recommended by von Noorden:

Breakfast: 7.30 A. M., 200 c.c. tea or coffee; 150 gm. beefsteak, mutton chops without bone, or boiled ham; one or two eggs.

Lunch: 12.30 P. M., 200 gm. cold roast beef; 60 gm. celery, fresh cucumbers or tomatoes with vinegar, olive oil, salt and pepper to taste; 20 c.c. whisky with 400 c.c. water; 60 c.c. coffee, without milk or sugar.

Dinner: 6.00 P. M., 200 c.c. clear bouillon; 250 gm. roast beef; 10 gm. butter; 80 gm. green salad, with 10 gm. vinegar and 20 gm. olive oil, or three tablespoonfuls of some well-cooked green vegetable; three sardines a l'huile; 20 c.c. whisky with 400 c.c. water.

Supper: 9.00 P. M., two eggs (raw or cooked); 400 c.c. water.

This diet contains about 200 gm. of albumin and about 135 gm. of fat. The effect of the diet on sugar excretion is remarkable. In many cases there is an entire disappearance of the sugar from the urine in three or four days. In cases in which the urine becomes free from sugar, gradually increasing quantities of starch up to 20, 50, and 100 gm. are added daily. White bread contains 55 per cent. of starch. The effect of the non-carbohydrate diet is to improve the metabolic functions so that the system can warehouse considerable quantities of carbohydrates without sugar appearing in the urine. In patients on a

strict diet who continue to excrete from 0.1 to 0.5 per cent. of glucose a *hunger-day* may be given, during which all food is cut off for twenty-four hours. A glycosuria may occur, and the patient's power of assimilating carbohydrates is increased; but this should not be tried if much diacetic acid is present.

In cases in which a standard diet is not ordered it is well to begin cutting off article by article until the sugar disappears from the urine. Within a month or two the patient may be allowed a more liberal diet, testing the different kinds of food.

The *oatmeal diet* introduced by von Noorden is most excellent, particularly in the severer forms: 250 grams of oatmeal, the same amount of butter, and the whites of six or eight eggs constitute the day's food. The oatmeal is cooked for two hours, and the butter and albumin is stirred in. It may be taken in four portions during the day. Coffee, tea, or whisky and water may be taken with it.

When diacetic acid is present, and if the weight is falling, the carbohydrates should not be too much restricted. Much acid means that glycogen storage is low, and the body has to resort to fats, which are with difficulty and imperfectly burnt. The more easily assimilated oatmeal and potato may be used freely, and alkalies given to neutralize the excess of acids.

The following is a list of articles which diabetic patients may take:

Liquids: Ox-tail, turtle, bouillon, and other clear soups. Lemonade, coffee, tea, chocolate, and cocoa; these to be taken without sugar, but they may be sweetened with saccharin. Potash or soda water, and Apollinaris or the Saratoga-Vichy and milk in moderation may be used.

Of animal food: Fish of all sorts, including crabs, lobsters, and oysters; salt and fresh butchers' meat (with the exception of liver), poultry, and game. Eggs, butter, buttermilk, curds, and cream cheese.

Of bread: Gluten and bran bread and almond and cocoanut biscuits. Aleuronat and roborat flours are made from wheat, and contain large quantities of albumin and but little starch. They may be used in making bread or biscuits and are highly recommended by Ebstein.

Of vegetables: Lettuce, tomatoes, spinach, chicory, sorrel, radishes, asparagus, water-cress, cucumbers, celery, endives, mustard, and various pickles.

Of fruits: Lemons and oranges. Currants, plums, cherries, pears, apples (tart), melons, raspberries, and strawberries may be taken in moderation. Nuts, as a rule, are allowable.

Among *prohibited articles* are the following: Thick soups and liver. Ordinary bread of all sorts (in quantity), rye, wheat, brown, or white.

All farinaceous preparations such as hominy, rice, tapioca, seminola, arrow-root, sago, and vermicelli.

Of vegetables: Potatoes, turnips, parsnips, squashes, vegetable marrows of all kinds, beets, corn, artichokes.

Of liquids: Beer, sparkling wine of all sorts, and the sweet aerated drinks.

In feeding a diabetic patient one of the greatest difficulties is in arranging a substitute for bread. Of the gluten foods many are very unpalatable; others are frauds.

Other substitutes are the almond food, the Aleuronat bread, and soya bread, but these and other substitutes are not satisfactory, as a rule. For sweetening purposes saccharin may be used, of which tablets are prepared. Mosse has shown that potato starch is more easily assimilated than wheat starch, and this view has been, on the whole, confirmed by comparative tests in my wards. He allows as much as a kilo ($2\frac{1}{2}$ pounds) of potatoes, weighed fresh, to a diabetic daily. They are best baked.

Patients with severe and chronic diabetes, until even dangerous acidosis is present, have wholly recovered after surgical operations, such as those about the prostate in males and ablation of the uterus in females. Such occurrences are absolutely inexplicable. Likewise the severe and prolonged diabetes caused, both in man and in animals, by the administration, whether by mouth or by intravenous injections, of phloridzin, a glucosid extracted from the bark of apple trees, cannot be understood. We may as well expect diabetes to be caused by paring the apples themselves. One fact, however, is well established, and that is, that each person has his own ability to use starches in his food. Many persons find that a marked excess in partaking of starchy foods causes glycosuria, but this varies with each individual, for whole races of mankind, like the Japanese, live upon almost nothing but rice, and yet they are no more subject to diabetes than other people. When glycosuria is caused in any person by excess of partaking of starchy foods it is termed "alimentary glycosuria," and this is readily cured by diminishing such intake. The clinical rule is, therefore, universally applied—viz., to find out how much any individual may partake of starchy foods without sugar appearing in his urine. In most cases this restriction in itself suffices to cure the complaint. In severe cases, however, as we have remarked, sugar still appears, even though all carbohydrates have been excluded. The sugar must then be formed from the protein tissues of the body itself.

The so-called alimentary glycosuria may happen in persons who are normally fat, and if it is not controlled by withdrawal of carbohydrate

food it soon yields to the administration of from 5 to 10 gr. of anti-pyrin with the same quantity of sodium salicylate. The treatment of diabetes by drugs is not satisfactory, except in persons after middle life, as we shall see. For a long time opium and its derivative codein have been reputed as the most efficacious of drugs. It should be undoubtedly used in those otherwise hopeless cases of diabetes in young persons. Opium may be given at the beginning, in doses of 1 gr. four times a day, gradually increasing until the patient shows symptoms of opium-poisoning by symmetric contraction of the pupils and slowing of the respiration. It is noteworthy that these patients show a great tolerance for opium. Pavy prefers codein because it is less constipating. He recommends it to be given in doses of $\frac{1}{2}$ gr., three times a day, to be gradually increased to 6 or 8 gr. in the twenty-four hours. As with all other drugs in the treatment of diabetes, no effect will be produced unless the patient is on a rigid diet.

Nature does not cure diabetes. In our chapter on Remedies we dwelt upon the fundamental difference between functional and constitutional remedies. The functional remedies are those whose whole action is secured by only one dose. No matter how long or often they may be repeated, the last dose does not do any more than the first dose did. The constitutional remedies, on the other hand, like iron in anemia or mercury in syphilis, do not produce their effects in one dose, but only after prolonged repetition of many doses. The reason for this is plain enough, because constitutional medicines affect the constitution, so that it is not the same as it was before taking them, and require time to produce the desired effect.

Functional medicines, on the other hand, do not affect the constitution, because the whole operation has been in one dose. On that account I cannot recommend for such a deep-seated constitutional disease a merely functional medicine like opium or any of its derivatives, like codein. A single poisonous dose of opium may imperil a man's life for half a day, but, if he survives for twenty-four hours, he is not only then safe from danger, but, in the course of another day, will be permanently free from any effects of opium, just as if he had never taken it. The only reason that opium or any of its derivatives are recommended for diabetes is that the percentage of sugar in the urine is temporarily diminished by opium, but a permanent cure of diabetes by this drug has never been reported. I but rarely prescribe opium; it can no more touch diabetes itself than it can touch typhoid fever, because it can never be anything but a functional medicine. Instead of that for a number of years I have advocated a

free use of cod-liver oil in diabetes. I was specially led to do this by its remarkable effect in the case of two brothers whom I treated forty years ago. The first, an active business man, aged thirty-five, came to me with polyuria, thirst, emaciation, and progressive loss of strength, for which he had been treated unavailingly for a year with the usual course of diet and drugs, including opium. He then took larger doses of cod-liver oil than any patient in my experience, for he said that he never measured it, but took it directly from the bottle as a drink, followed by Vichy water. In another year's time he was cured, and he has remained well ever since. His brother, two years younger, came to me the following year with much the same condition, so far as the great quantity of sugar in the urine was concerned. He found that he could stomach cod-liver oil as well as his brother.

Next to cod-liver oil I would mention iron. As before remarked, I have long suspected diabetes as largely a muscle disease, and, throughout the animal kingdom, muscular power is directly proportioned to the intake of oxygen. As iron can act in us only in the capacity of an oxygen carrier I try to give diabetics all the iron which they can take, with all the fresh air which they can get. As iron in many forms tends to cause constipation, which itself not infrequently becomes a serious trouble to diabetics, a very serviceable preparation for them is the old-fashioned Hooper's pill, the formula of which is ferrous sulphate, $\frac{1}{2}$ dram; powdered senna, powdered jalap, cream of tartar, powdered ginger, 12 gr. of each; extract of gentian, q. s.; divide into 30 pills; dose, one pill after meals.

The next agents are a class of very important medicinal antiseptics derived from the coal-tar series, such as antipyrin and phenacetin, including the salicylates and the benzoates. Besides these agents I would include arsenic in this class of antiseptics, as it comes nearer, in its properties as a medicine, to such agents than to any other. My usual practice is to combine it in the same prescription with them, and, therefore, I usually give arsenous acid itself, watching for the development of arsenical symptoms, just as in prescribing it for any other purpose. If called to a patient who is voiding so large an amount of sugar that a speedy reduction of it is imperative I would give 15 gr. of antipyrin, with the same of sodium benzoate, four times a day. In such acute cases illustrative prescriptions would be somewhat as follows:

R̄.	Benzosal.....	gr. xlviii;
	Sodium benzoate.....	℥iv;
	Arsenous acid.....	gr. j;
	Sodium salicylate.....	℥iij.—M.
	Ft. capsul. xlviii.	

Sig.—Two capsules an hour after meals and at night.

Also a prescription of

R. Sodium sulphocarbonate.....	℥ij;
Salicin.....	℥j;
Phenacetin.....	℥ij;
Ammonium benzoate.....	℥iv.—M.

Ft. capsul. xlviii.
 Sig.—Two capsules one-half hour after meals.

If there be much insomnia, 20 gr. of strontium bromid and 15 gr. of antipyrin should be taken at night. Lastly, a weekly dose of blue pill, followed by Pluto water or other laxative water in the morning, is very advisable.

By such means the life of diabetics can unquestionably be much prolonged, along with the preservation of their bodily strength, so that, in many instances, I have had the patient continue in active business for years.

DIABETES INSIPIDUS

This affection is characterized by polyuria or an increased flow of urine; the urine, however, is of low specific gravity and contains no sugar. It may or may not contain a fair amount of urea, but usually it is deficient in all the solids, urea included. The urine may be much more in quantity than can be accounted for by the amount of water drunk. I once had a patient, in the case of a young man, who was at the time suffering from great nervous depression, when he voided a very large quantity. These patients are often thirsty, but even thirst may be absent. There can be no doubt that the skin is wholly unable to absorb any water as such, yet quickly absorbs large quantities of water when in the form of vapor.

Watson mentions the case of a jockey at the Newmarket races, who had been starved down to a prescribed weight before he mounted his horse; the day, however, was quite foggy, and he begged for a cup of tea, after which, on being weighed again, he was found to have increased six pounds in weight.

Workers in glassmakers' furnaces have been known to lose three pounds in weight while at work, and then, in a short time, recover their weight on ceasing work without meantime drinking a drop.

These facts should be remembered before advising a patient with diseased arteries to take a vapor or Turkish bath. Every one on first entering a Turkish bath is apt to feel dizzy from the effort of rapid absorption by the skin of watery vapor. This vascular fulness is soon relieved by the breaking out of free perspiration. I have known,

however, of serious injury occurring to persons with diseased arteries on taking a vapor bath.

Cases of diabetes insipidus are usually cases of neurotic temperament. I had a patient at the Roosevelt Hospital who was admitted for general debility, and who habitually voided 110 and more ounces of water daily, which was more than could be accounted for by what he drank. I then put him upon the treatment recommended by Trousseau for this condition, which was to administer free doses of valerian. This quickly relieved him, but when he passed a normal quantity of urine he suddenly developed gangrene of the lung and died.

RACHITIS, OR RICKETS

Rachitis, or rickets, is a name applied to this disease by the eminent English physician, Glisson, about 1650. It is a very common disease in both sexes, beginning in infancy, and is so common in London and Vienna that from 50 to 80 per cent. of all the children at the clinics present signs of rickets.

Rickets is a disease which strikes at the very foundation of our physical life. We no longer regard the bones as merely the framework of the body, for we now know that in the marrow of the bones the blood itself finds its origin. A real fault in bony development, beginning as rickets usually does in infancy, for its presence can be easily recognized in a child but two years old, gives a very serious outlook for the rest of life. All the tissues of the body, therefore, must suffer more or less from general faults in development in the bony structures. In rickets there is a marked deficiency in bony organization, due to the want of phosphate of lime, which deficiency may be as low as 25 or 35 per cent. On this account, the mere weight of the body or of its parts may be sufficient to cause serious deformities in their development. Thus, in females the pelvis may be so changed from its normal shape that the anteroposterior diameter of its brim may be reduced to one-half or one-third of its normal length, thus rendering in after life parturition difficult or impossible. Meanwhile, irregular growths may be found in the bones of the head, the upper part of the skull being so misshapen as to resemble what we have described in our remarks on hydrocephalus of a small face overhung by protuberant frontal and parietal bones. The long bones of the extremities, particularly of the legs, are misshapen, their shafts being small and weak, while their ends at the articulations may be much distorted; the spine also is equally affected, especially in its upper part, owing to the weight of the head.

Meantime, as might be expected, the general nutrition seriously suffers, the skin is but poorly developed, and often the seat of superficial pains, so that the child prefers to lie in bed, because every movement of the body causes pain. Meantime the abdomen is protuberant with relative enlargement of the liver, spleen, and mesenteric glands. These children are late in their dentition and slow in learning to walk, owing to the weakness of their legs.

One, and by no means minor, difficulty of these patients is from misshapen chests, producing what is called the pigeon breast, in which the sternum is not only too prominent, but the articulations of the ribs are so irregular that they form projections or the so-called rickety rosary.

Rickets is a disease of early childhood; in exceptional cases it may develop as late as the fourth or fifth year.

Treatment.—The greatest remedy for rickets is an early administration of cod-liver oil, a remedy well borne by all children, who may even show a fondness for it. Next to cod-liver oil comes calcium lactate, which may be given in 10- or even 15-gr. doses four times a day with milk.

SCLERODERMA

This is an affection of the skin in which its tissue becomes much thickened. It is very irregular in its distribution, its most common sites being about the neck. It cannot be called an inflammation of the skin, as it has no relation to any of the forms of dermatitis. A local development of this trouble is sometimes seen in which the growth of the nails becomes very distorted. When it affects the hands it stiffens them so as to make writing and movements of the fingers difficult. Occasionally, the parts affected become deeply pigmented.

Treatment.—Very favorable results in its treatment have been reported by the administration of thyroid tablets in 3- to 5-gr. doses, three or four times daily; otherwise it seems not to be amenable to any of the remedies for cutaneous diseases.

OBESITY

Physicians are often consulted, particularly by women, for advice for reducing fat. Such cases require, first, a careful investigation into the daily habits of the patient. In many cases the tendency to increase in bodily weight from deposition of fat is a hereditary complaint, but it is often conjoined with an abnormal appetite, and can be treated by cutting down the intake of starches and of sweets.

It those who can afford it a prolonged horseback ride over high and dry plains proves very efficacious, by not only reducing the fat, but by greatly increasing the physical vigor of the patient. In some cases there can be no doubt that obesity is due to perversion of the hypophysis or pituitary gland, which is characterized by a great increase in fat in early life and by infantilism in the sexual glands.

Treatment.—We have only one agent which directly lessens the fat in the body, and that is, extract of the thyroid gland. We might infer that the thyroid has the property of reducing fat from the common supervention of emaciation in Graves' disease. I once had a patient with Graves' disease in which I was obliged to pad the patient with cotton batting to prevent the bones from cutting through the skin; on curing her of Graves' disease she became perfectly normal in the restoration of the subcutaneous cushion of fat, which, in health, preserves the nerves from being pressed upon by the bones, as described in our chapter on Emaciation.

The administration of thyroid tablets should not, at the beginning, be left to the discretion of the patient, but they should be given by a trained nurse, for it would be easy for the patient to exceed the proper dose of these tablets, with the production of tachycardia and much general debility. The dose should be, at first, not more than 3-gr. tablets, gradually increasing to 5-gr. tablets, three times a day.

FATTY TUMORS

Fatty tumors will be considered later, under the head of New Growths. There is one variety, however, called *adiposis dolorosa*, or Dercum's disease, characterized by fatty deposits under the skin which are painful to pressure. The etiology of these cases is obscure, and they are best treated by local applications of anodyne liniments, such as camphorated oil, 1 oz.; tincture of opium; 2 drams, and menthol, 1 dram.

It may be well here to allude to hysteric tumors. These are often definitely circumscribed, tumor-like swellings on the surface of the abdomen. I once heard a well-known gynecologist begin a lecture on ovarian cysts previous to his operating upon the tumor, but when the patient was passing under an anesthetic the tumor entirely disappeared.

CHAPTER XII

DISEASES OF THE DUCTLESS GLANDS

INTRODUCTION

THE ductless glands are so-called from their secretions being discharged directly into the blood instead of flowing through ducts proceeding from them. As their secretions, therefore, cannot be collected for examination, we know little about them, except by noting the effects of their absence in cases of excision or atrophy.

The ductless glands vary greatly in size between themselves, from the thyroid, which may weigh from 500 to 1000 gr., to the pituitary gland, which weighs only 5 gr. But the importance of their functions bears no relation to their size or weight. They are all about equally necessary at some time to the nutrition and life of the body, though their importance varies much with age. Thus, the thymus passes out of commission at an early period. The thyroid also is a temporary organ that atrophies in old age, which, if experimentally removed, is quickly fatal to young dogs, while old dogs are but little affected by this operation, and its importance, though great, is chiefly concerned with the reproductive period of life.

No organ of the body is so often hypertrophied as the thyroid, forming then what are called goiters. These vary greatly in their causation. A larger class of them are caused by something in the water drunk, it may be in very restricted localities. Thus, Lombroso and other Italian writers speak of goitrous wells, the drinking-water of which is resorted to for the purpose of developing goiters so as to exempt the men from military service. The waters of these wells also cause goiters in dogs and in horses.

Endemic goiters occur in all parts of the world. In England we read of the Derbyshire neck, and this affection is very prevalent in valleys in Switzerland and in the Pyrennees. It is not, however, by any means limited to mountainous districts, for it may be equally prevalent in plain or flat regions. For a long time it was supposed that waters containing lime or magnesium salts were the cause of endemic goiters and also of the prevalence of cretinism, but this hypothesis is now abandoned. One of the most instructive investigations

on this subject was made by Dr. Robert McCarrison, a British surgeon in India, who observed endemic goiter in a number of localities in Gilgit and Chitral, in the Himalaya regions, recorded in the Milroy lectures of 1912. He conclusively demonstrates that the infected waters are not so on account of any geologic formation, and concludes that the disorder is due to a living growth, but whether bacterial or protozoal has not yet been demonstrated. It passes through the pores of a Berkefeld filter, and seems to be highly resistant to heat, requiring at least 70° C. to render the water innocuous. One of the most striking diseases is due to atrophy of the thyroid gland, causing the disease first described by Sir William Gull, but which goes by the name myxedema, given to it by Dr. Ord. In former times this disease was produced by surgical operations, in which the whole thyroid gland was removed by Dr. Kocher, of Bern, Switzerland, but it was not until this operation was shown to be the actual cause of myxedema that it was abandoned. Myxedema, however, sometimes seems to occur spontaneously, but in every case when the complaint ended fatally, autopsy showed complete atrophy of the thyroid gland. The symptoms of myxedema are first a gradual failure of strength, then a slowness of speech with dulness of the mind. Clinically, however, the symptoms are very distinct, and consist of general puffiness of the face, beginning with the eyelids, with thickening of the lips and of the alæ nasi, and extending until the whole face looks broad, without expression, and the hands enlarged, with fingers becoming so thickened that the hand has a spade-like appearance. Meantime the subcutaneous tissues are infiltrated with a mucin-like fluid, which is not true edema, for the skin does not pit on pressure. This is early developed in the neck, especially about the clavicles. The patients become very sluggish in their movements, and complain greatly of the cold, their temperatures sometimes falling to 95° F., and death occurs from heart failure.

That this affection is due solely to atrophy of the thyroid gland is shown by the remarkable efficacy, particularly demonstrated by Dr. Hector MacKenzie, of the administration of extracts of the thyroid gland of sheep. This is now sold in compressed tablets, usually of 5 gr. each, and may be taken by such patients, one three times a day, to be afterward diminished, according to the improvement of the patient, to only one a day, or even one a week. Overdosing with thyroid tablets produces nervousness and rapid action of the heart, which symptoms soon cease on diminishing the dose, and it is undeniable that all of the serious symptoms of myxedema are surely cured

by thus supplying artificially the normal secretion of the thyroid gland.

The thyroid gland, like the pancreas, is a compound organ, because embedded in its substance are small bodies, distinct from it in function, called the parathyroids, usually four in number, two on each side of the gland. Halsted and MacCallom have demonstrated that they are necessary for life, because their experimental removal in animals has been followed by fatal tetanus. In milder degrees, twitching and cramps of the muscles, usually those of the extremities, take place, to which the term "tetany" has been given. MacCallom has shown that these bodies bear an important relation to the presence of calcium in nutrition, especially of the nervous system, and recommends the administration of calcium lactate for affections caused apparently by deficiency in parathyroid secretion. Besides tetanoid cramp, the animals experimented upon developed general muscular tremors, which were noted as results of complete thyroidectomy, before the presence of the parathyroids was known. It is not improbable that the tremors so generally present in Graves' disease are due, in part at least, to implication of the parathyroids. It is now generally admitted that the morbid condition termed "tetany" is connected with implication of the parathyroids. In this country tetany occurs chiefly among children, and consists of spasmodic contractions of the muscles of the different parts, but chiefly of the extremities. It may last from a few hours to several weeks. In my experience it occurs oftenest in children with gastric intestinal disorders, particularly diarrhea. It is best treated by the administration of 15 gr. of calcium lactate, four times a day. Some do well simply with doses of thyroid extract.

DISEASES OF THE THYMUS GLAND

The thymus is a ductless gland whose functions are very obscure. Its entire removal without injury to the general health has been successfully performed in a number of instances. Owing to its position, the thymus may produce difficulty in breathing by compression of the trachea. Sudden death in infants has been often reported and ascribed to disorders of the thymus gland without any clear reasons being adduced for the fatal event. We have, therefore, to deduce our conclusions about the relations of this gland, namely, from its apparent connection with the lymphatic system. I once thought it probable to suppose that it had close connection with the origin of the white corpuscles of the blood, because disorders of the lymphatic system are so often accompanied by enlargement of the thymus.

The thymus is, like the thyroid, a temporary body, and atrophies with advancing years. Thus, as we have stated in our article on Graves' Disease, extirpation of the thyroid is quickly fatal in young dogs, while old dogs bear this excision very well, showing that the thyroid is related closely to the reproductive period of life. Similarly, the thymus is a temporary gland, and after twenty-five years it gradually atrophies. We hear, therefore, of persistent thymus, as associated with diseases of the lymphatic system, but no disorders of this gland have yet been identified with any distinct derangement of other organs. In all conditions of so-called lymphatism the heart is found weak, and, therefore, the administration of either chloroform or ether is contra-indicated.

The so-called *status lymphaticus* is characterized by weakness of the heart and of the arteries in general. The patients are usually sluggish, easily fatigued, and have a yellowish pasty complexion, in all of whom the thymus is often reported as persistent, when naturally it ought to have entered upon its retrogressive changes.

Attacks of labored breathing with stridor have been reported as due to hypertrophy of the thymus gland pressing from its position upon the trachea, but there is a divergence of opinion among authors on the connection of these attacks with hypertrophy of the thymus, because such attacks frequently occur in spasmodic croup without any relation to conditions of this gland.

DISEASE OF THE PITUITARY GLAND: ACROMEGALY

The pituitary gland is located in the most inaccessible part of the skull, called the "sella turcica" or Turkish saddle, which is a remarkable depression in the sphenoid bone. This gland is also called the "hypophysis," and weighs only 5 gr. It is comprised chiefly of two parts, the anterior lobe, which is larger, and the posterior lobe, called the pars nervosa, connected by an intermediate portion, the infundibulum. It must be a body of primary importance, because its excision is invariably and quickly fatal. Moreover, disease of the pituitary gland is accompanied by very striking change in the growth and nutrition of the body, producing great hypertrophy of the hands and feet, which are much enlarged, though not deformed.

We have already alluded to the remarkable association of the ductless glands with each other in their functions, so that in cases of enlargement of the thyroid we often find hypertrophy of the pituitary also occurring, while the pituitary, the pancreas, and the adrenals appear to be simultaneously affected in some conditions of glycosuria.

It is to Harvey Cushing, of Johns Hopkins University, that the most recent advances in the knowledge of the pituitary gland's functions have been made. He has shown that tumors, like adenomata growing in the neighborhood of the pituitary gland, may either occasion by their stimulation an increase in the growth of bones, such as gigantism, as the first step toward the development of acromegaly, or, when such growths have caused atrophy of the pituitary gland, and thus interfered with its functions, that the opposite effect of dwarfism and a reversion to infantile development of the generative organs may occur, with a marked tendency to increase of fat in the body.

Coincident with the increase of fat and infantilism there is a notable increase in the power of the body to assimilate the carbohydrates.

The physical features of acromegaly are very striking. "The skull increases in volume, but not so much in proportion as the face, which becomes elongated and enlarges in consequence of the increase in the size of the superior and inferior maxillary bones" (Osler). The latter particularly increases in size, and often projects below the upper jaw. The external ears may also be much enlarged. Meantime the bones of the extremities become both enlarged and elongated, with hypertrophy of their cartilages. All features contributing to gigantism are associated with acromegaly. It has long been noted in the bodies of giants that the sella turcica is much hypertrophied.

Treatment appears to be of no avail in this remarkable complaint.

Extracts made of the posterior lobe of the pituitary raise the blood-pressure and act as diuretics, not unlike the action of digitalis.

THE ADRENALS: ADDISON'S DISEASE

A great deal of work has been expended upon the origin and functions of those two ductless glands, which are called the adrenals, from their situation on the top, but which have no anatomic connection with the kidneys underneath. The origin of an adrenal gland is directly traced to a branch of the abdominal sympathetic, which becomes rolled upon itself like a ball of twine, and then, separating from its attachment, it takes a capsule, and thus forms an adrenal gland. These adrenal glands are more directly necessary to life than the kidneys themselves, for animals more quickly succumb to the effects of their excisions than when the kidneys are removed.

The function of the internal secretion of the adrenals is shown to consist in the maintenance of the excitability and tone of the vasomotor nerves throughout the body, because, after excision of the adrenals, stimulation of the vasomotor nerves no longer causes the arteries either

to actively contract or to dilate. This is all due to the presence in the secretion of a powerful agent called adrenalin, which is now isolated from the secretion, and is the only example, so far known, of an actual drug being formed by a gland which is sold like any other drug over the counter.

The properties of adrenalin are very distinct, and consist of immediately raising the blood-pressure through active contraction of the arterial walls. Due to its contracting the arteries, adrenalin has many uses, such as by local application to arrest hemorrhage or to produce arterial anemia in part. It may also be owing to excess of adrenalin in the blood that atheroma occurs in the coats of large arteries, for such results have followed experimental administration of adrenalin in the coats of the aorta in rabbits.

Addison's disease derived its name from the eminent English physician of Guy's Hospital, who first described it in 1835. His attention was first directed to it by a remarkable discoloration of the skin which ordinarily accompanies this complaint. This discoloration is very variable, both in its situation and extent, ordinarily appearing first on the sides of the neck, and extending thence, with deepening of its shades, to the axilla and other parts, where the skin may be folded on itself, becoming, as it deepens in tint, like the color of bronze. In other cases it appears first on the inside of the lips and in the buccal cavity. I have known it, however, to be found only scattered along the processes of the spine.

Addison then found that this discoloration was accompanied by disease of the adrenal glands themselves, commonly due to tuberculosis, either destroying the gland or implicating the adjoining tissues, especially when that great center of the abdominal sympathetic, the solar plexus, was involved, from which, as we have seen, the adrenals take their origin. The disease, however, does not depend upon tuberculosis, because the same results follow if the adrenals are invaded by cancer.

Symptoms.—As might be expected from a disease which involves so generally the abdominal sympathetic, various digestive disturbances occur early in the course of this disease, such as abdominal pains, referred to the alimentary canal, and disturbances of the stomach and bowels. But the most constant accompaniment is general muscular weakness and debility, ultimately, if not checked, leading to death from pure asthenia, not at all due to changes in the blood nor in general nutrition, for the blood remains nearly normal, and the patients do not lose flesh or color.

No treatment for this complaint was known until the deficiency was supplied by the administration of tablets made from the adrenal glands of sheep.

I had a patient come to me with unmistakable symptoms of Addison's disease, including bronzing of the skin of the neck. He was a well-to-do farmer in the western part of New York state, and I put him at once upon tablets of the extract of the adrenal glands, put up by Burroughs, Wellcome & Co., of London. He rapidly improved under their administration, and was enabled to resume his business, his skin wholly clearing up. But one singular result was that he had been married for ten years without having any children, while after taking the tablets he informed me that his wife bore two boys, one of whom, at last accounts, was going to college. He, however, has to take his tablets continuously, for so soon as he omits them all the symptoms of his complaint begin to reappear.

Addison's disease is not at all common in the United States. I have seen only 3 cases of it in private practice, but it is so peculiar and unmistakable in its symptoms that its diagnosis is not difficult.

THE THYROID: CRETINISM

This morbid condition appears in children, in some cases from birth, though usually not until the end of the first year, when it may be noted that the child seems backward both in growth and in mind. Occasionally, all goes well for the first few years, when it ceases to develop, its features alter, and it becomes dull and stupid. As it becomes older it looks dwarfed and stunted, and Hector MacKenzie adds the following graphic description:

"A disproportionately large head, a short, deformed body, with thick arms and crooked legs. The head is flat at the top, narrow in front, and broad behind. The face also is broad, but without expression, and often wrinkled, as in the aged, with a pale waxy complexion. The eyes have swollen lids and are wide apart; the nose is broad, depressed at the root, and the nostrils widely opened, as in the negro. The cheeks below the prominent malar processes are loose and flabby. The ears are large and thick and the lips negroid, with the mouth open and drooling. The lower jaw is thick and broad, the neck short and thick, and may have large fatty masses both felt and seen above the clavicles. The head often hangs forward on the chest, the erector muscles being too weak to support its weight; this produces a curvature of the cervical and upper dorsal spine. The breast is strikingly flat, and the chest is round and expanded at the base, while the costal

angle is wide. There is usually bowing of the lower dorsal and lumbar spine, and the abdomen is characteristically large, protuberant, and pendulous. There is frequently an umbilical hernia. The hips are small and the limbs are short and thick. The hands are broad, short, and podgy, and their skin is thick, especially on the dorsum, and wrinkled. The legs are often bowed, the ankles are enlarged, and the feet are thick and square. The nails are short, thickened, cracked or chinky, and ill-shaped. The skin is yellowish white, dry, branny, and rough to the touch. It feels doughy from the thickening of the subcutaneous tissues, is loose, and hangs in folds over the abdomen and at the flexures of the joints. Sweating is exceptional, but absence of perspiration is not so constant as in myxedema. Moles or pigment spots or patches of a yellowish or brown color or warts are not uncommon on various parts of the body. The hair is short and scanty, and is coarse, dry, straight, and sometimes bristly, more like horsehair than that of the human being. In adult cretins it is usually absent on the body. The eyebrows are often scanty, but may be well formed. The scalp is dry and scurfy, and is sometimes covered with yellowish or brownish crusts. The teeth are late in appearing and soon become carious. In sporadic cases there is usually no evidence of the presence of the thyroid gland, but there may be enlargement of the gland or a goiter, and this is common in the endemic cases. The temperature is subnormal; the child is always cold, likes to be near the fire, and is very sensitive to any fall in the thermometer. In cold weather the exposed parts of the body become blue. The bowels are frequently obstinately constipated and the breath has a disagreeable odor. The urine is usually large in amount, but is otherwise normal. There is generally control over the sphincters, and when there is sufficient degree of intelligence the patients are cleanly in their habits. The blood shows little change in corpuscular elements, but there is usually deficiency in the amount of hemoglobin, which may be no more than 50 or even 40 per cent. of the normal. In some cases there has been a tendency to hemorrhages, especially from the nose. The intellectual condition of the cretin is always extremely low. The mental capacity varies from that of a low-grade idiot, on the one hand, to that of a child of four or five years old, when the cretin is grown up, so to speak. The cretin does not learn to talk or to walk at the usual time, and does not attempt to move about like an ordinary healthy child. Sometimes, so far from learning to walk, it remains unable to stand or sit unless propped up and supported. In other cases it may only be able to move about by crawling on all fours. Eventually, however, the power of

walking may be acquired, but the gait is waddling and clumsy. The power of speech sometimes remains altogether undeveloped. Sometimes the cretin cannot even cry or scream like an ordinary child, and expresses pleasure, anger, or fear by means of inarticulate grunts, howls or shrieks, barks, or groans only. In course of time it may learn to say a few words, such as 'yes,' 'no,' 'mamma,' or 'pussy,' and it may learn to understand a little when spoken to. It may also learn the signification of gestures. A small number acquire a more extensive vocabulary, which is, however, very much restricted, and is composed almost entirely of monosyllables. Many of the consonants are very imperfectly pronounced. The voice is often harsh and hoarse. The cretin is usually dull of hearing; the degree of deafness is generally proportional to the stage of the disease. The deafness accounts for some of the mental dulness, and, to some extent, for the inaptitude of speech. Smell and taste are usually imperfect. Cretins often appear insensible to bad odors, and indifferent whether food is palatable or not. Sight is one of the senses the least affected. Usually it is normal, but the retina does not seem so sensitive to strong or dazzling light as in ordinary persons. The cretin has been observed to sit with the sun full in his eyes for a long time.

"In adult cretins the genital organs remain those of a child. There is absence of hair over the pubes, the axilla, and elsewhere on the body, and hair does not appear on the face in males. Males have a diminutive penis and small testicles, and females have the labia of little girls and an infantile uterus. The catamenia are absent or irregular, and sexual instinct is, as a rule, undeveloped. In high-grade cretins there may, however, be some evidence of development of sexual appetite and instinct.

"The cretins are usually good-natured and placid, and, although stolid, are easily amused. It is sometimes difficult to attract their attention by appealing either to the sense of hearing or sight. They are apathetic and phlegmatic, and very slow and deliberate in all their movements. They are somnolent, and will sometimes sleep almost indefinitely if undisturbed. During sleep they breathe noisily. When awake they are lazy and inert. They will remain in the same position, and play for hours without moving or taking any apparent interest in surroundings; one cretin will take a full minute to raise her arm when asked to shake hands."

Treatment.—Such is a good description before modern medicine discovered how to heal this wretched disorder. In the Middle Ages they suffered from barbarous enactments designed to rid the com-

munity of their presence. This was but a reversion to the habit of animals putting to death wounded or disabled fellow animals. It is one of the brightest discoveries of modern medicine that cretinism is due to the absence or failure of the functions of the thyroid gland. In many cretins postmortem examination shows little or no trace of the thyroid existing. In 1891 Prof. George Murray showed how myxedema could be cured by the administration of the thyroid gland of sheep, and shortly afterward it was discovered by Dr. Hector MacKenzie, Dr. E. L. Fox, of Plymouth, and by Howitz, of Copenhagen, independently, that administration of sheep's thyroid by the mouth was as effective as by any other method for curing the disease. If taken early enough, this treatment restores the bodily growth and the mental ability of these previously unfortunate patients, so that they are not inferior in their physical and mental development to others of the same age. This treatment, however, should be undertaken early to show its best effects, but even in adolescence, cure, if not at least marked improvement, in all respects occurs. The best preparations are the thyroid tablets, put up by Messrs. Burroughs, Wellcome & Co., of London. The dose which has to be given varies in amount. In commencing treatment we must feel our way. If too large a dose be given, great constitutional disturbance may be produced. Even a dose of 5 gr. has made a patient feel ill, causing fever, excitement, depression, and general pains in the body and limbs. A small dose, 1 gr. of the thyroid tablet or 1 minim of liquor thyroidei, is sufficient to start with, and this should be cautiously repeated at short intervals, treatment being suspended when any undesirable symptoms are observed. In 1 case a dose of $1\frac{1}{2}$ gr., given every third day, has sufficed to cure the patient and afterward to keep him well. In another, gradually increasing doses, up to 3 gr. a day, were found necessary. Sometimes as much as 10 gr. daily has been required, and a smaller dose has not sufficed. In one of my patients a dose of 10 gr. a day has now been taken for the past twelve years. Probably 5 gr. a day may be considered as an average dose necessary to keep the patient well when the symptoms of the disease have all disappeared. As in the case of myxedema, the remedy must be regularly taken during the whole of the patient's life. Should the remedy be suspended, myxedematous symptoms gradually reappear. One of the most remarkable effects of the treatment is that the growth which has been so completely arrested almost immediately recommences, and it is not unusual for a young cretin to grow several inches in six months.

There could scarcely be a more impressive illustration on the

importance of the thyroid gland to all bodily nutrition than that which cretinism furnishes.

GRAVES' DISEASE

Graves' disease has attracted a great deal of attention on the part of the medical profession. Kocher published, in 1903, a bibliography of this disease at that time, and it amounted to 1400 treatises or papers on the disease, and since then the accumulation of such written references to it has been even more remarkable.

Symptoms.—It is always unfortunate for a disease to be named after any of its prominent symptoms, because it may happen that those symptoms are absent in undoubted cases of the disease. This naturally leads to the malady itself not being recognized, though actually present. Thus, I have several times been called in consultation in cases of true tabes, not recognized because of the absence of locomotor ataxia, while the gastric crises accompanied by severe vomiting were present. But this disadvantage is especially characteristic of Graves' disease from the name of exophthalmic goiter being so commonly given to it. In my monograph on "Graves' Disease, With and Without Exophthalmic Goiter," I detailed the history of 41 cases in which there was exophthalmos and goiter, and compared them with 27 cases of true Graves' disease, in which there was neither goiter nor exophthalmos. We should note here that there is no chronic affection which has so many characteristic symptoms as Graves' disease, at least in its grouping. Hence, it presents us with a clinical picture which is more definite and unmistakable than any other known serious malady.

To demonstrate this fact, we give the following distinctly characteristic symptoms of Graves' disease, excluding both goiter and exophthalmos from the list. These symptoms are twenty-seven in number and are as follows:

- | | |
|---|-------------------------------------|
| 1. Tachycardia. | 6. Mental symptoms: |
| 2. Palpitation. | (a) Depression. |
| 3. Nervousness. | (b) Changes of disposition. |
| 4. Muscular tremors, general and special, | (c) Mania. |
| with these characters: | 7. Special affections of the ears. |
| (a) General muscular weakness. | 8. Special affections of the eyes. |
| (b) Local weakness of the knee. | 9. Affections of smell. |
| (c) Local weakness of the voice. | 10. Pains: |
| (d) Abasia. | (a) General. |
| (e) Aphasia. | (b) Localized in neck, finger-tips, |
| 5. Local paralyses. | nose, heels, and in external ears. |
| | (c) Muscular pains. |

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| 11. Headaches. | 20. Pigmentation of the skin. |
| 12. Vertigo. | 21. Itching. |
| 13. Paresthesiæ. | 22. Sweating. |
| 14. Characteristic disorders of the stomach. | 23. Irritability of the bladder or vesical irritability. |
| 15. Characteristic disorders of the intestines. | 24. All symptoms worse in the morning and better in the evening. |
| 16. Bulimia. | 25. Disease chronic. |
| 17. Emaciation. | 26. Family complaint. |
| 18. Insomnia. | 27. Death sudden from syncope. |
| 19. Loss of hair. | |

Now, the theory of the thyroid origin of Graves' disease affords no explanation to the greater liability of women to the complaint. In my list of the patients with goiter there are 36 women to 6 men, and of those without goiter 24 women to 4 men, a ratio in keeping with other statistics of this disease. It is difficult to imagine why the thyroid itself should so differ between the sexes as to account for the preponderance of women, but it is quite otherwise when we take into account the proneness of women to gastro-intestinal derangements in connection with menstruation, pregnancy, and the menopause. Lastly, I hold that the results of treatment, based upon the gastro-intestinal origin of the toxemia of Graves' disease, are unmistakably superior to any measures, whether medical or surgical, devised on the thyroid theory, and which all go to confirm the inference that diet and digestion and disorders connected therewith are the chief factors in the etiology of Graves' disease.

The mechanism of the exophthalmos is as yet wholly unexplained. Like the other symptoms of the complaint it is variable in its incidence. In my 42 cases who had goiter it was present in 19, among whom it was but slight in 5, present in one eye only in 1, and in both eyes in 1 woman who had no goiter at all. It was absent in the remaining 22. This variability in the occurrence of exophthalmos in my list is in keeping with the records of others. Glycosuria is an occasional epiphenomenon in Graves' disease, but, though some writers make a great deal of it, I would not assign to it any more important relationship than I would to albuminuria.

A further clinical fact should be emphasized, namely, that the majority of these symptoms, whether motor, sensory, or nutritive, are peculiar in the forms which they assume in Graves' disease, and unlike similar symptoms in other affections, as we shall now see; which proves that none other than Graves' disease is present, though both thyroid enlargement and eye protrusion are equally wanting. Not till this is done can one recognize the singular definiteness of this disease. In

each of my fatal cases without goiter scarcely one of the above outlined characteristics failed to occur, while with the remainder the average frequency of their incidence is the same between those with and those without goiter.

Tachycardia.—The first of these specific symptoms of Graves' disease is a long-continued rapid action of the heart. To be characteristic, the pulse should range from 90 to 120 or more, and such frequency should be chronic and persistent, always present at every examination through months and it may be years, and be entirely independent of any other cause of tachycardia. It is this pronounced tachycardia of Graves' disease which will then be recognized as peculiar and specific, and, therefore, dependent on its own particular cause without the participation of any different element or condition.

These postulates would exclude, to begin with, all cases of rapid action of the heart from nervous excitement. Patients with Graves' disease very generally appear to be under the same undue agitation which makes the hand shake and the voice tremble. It is easy, therefore, to mistake their tachycardia for the rapid pulse of merely excited patients, particularly as they themselves often complain that they are nervous, and this mistake is all the more likely if the existence of Graves' disease does not occur to the physician because of the absence of goiter and exophthalmos, but time and repeated examinations will show the difference from the merely excited pulse to be great and unmistakable. Those who are only nervous will ere long calm down, and the pulse-rate will fall accordingly. The Graves' pulse never calms down, however quiet the patient may become. It runs as fast or faster than in any fever or inflammation, by day and by night, and also in sleep, with less change at each counting over long periods than in any other affection. Equally easy is it to exclude the quick pulse in anemic or debilitated patients after physical exertion, because then it soon falls with rest, particularly after lying down, but the tachycardia of Graves' disease may continue with little or no change, though the patient be kept recumbent for months at a time.

The tachycardia of all fevers can be at once excluded by the thermometer, which in Graves' disease rarely varies from normal.

Graves' disease cannot be termed a febrile complaint; and hence its pulse-rate has no connection with such a condition.

Inflammatory or organic changes in the heart itself can equally be excluded as causes of this tachycardia. Instead it is remarkable how long this overaction of the heart may continue in Graves' disease without showing postmortem either hypertrophy or inflammatory lesions

of any kind. In some the heart walls are found postmortem more or less degenerated, but not more so than the texture of other organs, which suffer alike from the widespread derangement of nutrition which precedes death in this complaint.

Tachycardia is an occasional accompaniment of certain cerebro-spinal affections, particularly tabes, but these in turn can be excluded by the entire absence of their characteristic symptoms in Graves' disease.

After all such causes of rapid heart action are excluded the pronounced and strikingly persistent tachycardia of Graves' disease then appears as a singular, pathognomonic symptom. No other form of tachycardia compares with it for long continuance. I have known it to remain unchanged for nine years, and in more than half of the cases it lasts over two years. It must also hold some important relation to the disease itself, which is far more constant than either the goiter or the exophthalmos, for I found it absent in only 2 of my 70 cases. These considerations definitely indicate that this peculiar state of the heart constitutes one of the essential symptoms of Graves' disease, but this tachycardia is found fully as often, and quite as marked, in those patients who show no evidence of thyroid enlargement as in those who do.

Palpitation as a symptom is quite distinct from tachycardia, for the latter may exist in high degree, as in fever, and yet the patient be wholly non-cognizant of it. On the contrary, the patient is always conscious of palpitation, and frequently is much alarmed by it. He feels the heart stop, then bound violently, then beat irregularly, then rapidly, all in turns, and if it occurs at night it banishes sleep by the nervousness which it occasions.

We may say here that in all which follows we propose to demonstrate that the origin of Graves' disease is not due primarily to any affection of the thyroid gland. Instead, where the thyroid gland is hypertrophied in this complaint, the goiter is secondary, and not the original cause of Graves' disease, just as enlargement of the spleen may occur in malarial fever, but may also occur in other affections which have no connection with malaria.

Among the prominent symptoms of Graves' disease are *pains*, of great variety as to their seat and nature, for they are both general and local in their distribution, but nevertheless they usually present some features in common which render them characteristic of this malady. Some of these pains are characteristic on account of the parts implicated, like the palms of the hands, the tips of the fingers, and ends of

toes and heels. In one case without goiter the palms of the hands were extremely painful. Pains in the tips of the fingers were noted in 6 cases with goiter and in 5 cases without goiter; in the toes in 2 cases of goiter and in 3 cases without goiter. Pains in the heels were noted in 1 case with goiter and in 5 cases without goiter. They were all characterized by sensitiveness to pressure, like the tenderness of the external ears, and in those in whom the heels were involved walking was rendered difficult. The tenderness, however, in all cases seemed to be very superficial, and not even when in the heels could it be termed articular, for the ankle-joint could be freely moved without pain.

True muscular pains, on the other hand, are very frequent, and in patients without goiter are often mistaken for rheumatism, as the affected muscles become stiff and painful upon movement. They differ from rheumatism in that the muscles implicated are not painful on firm palpation, show no heat or swelling, are not affected by changes in the weather, and, moreover, the pains are very shooting, appearing and disappearing much more rapidly than do rheumatic pains, and very commonly are better in the evening than in the morning. Unlike muscular rheumatism, they rarely are referred to the back. One of the commonest sites is in the muscles of the neck, particularly in the sternomastoid and the upper division of the trapezius. The left side of the neck is affected about twice as often as the right, having been noted in 7 cases with goiter on the left, in 5 cases with goiter on the right, and in 3 cases with goiter on both sides, while in the cases without goiter they occurred in 5 patients on the left, in 2 on the right, and in 1 on both sides.

These pains, moreover, may affect the muscles of both the upper and lower extremities quite extensively. One case, a lady, for two years before goiter developed was greatly annoyed with nocturnal pains in the anterior aspect of both thighs; and the same kind of pains occurred in 1 case without goiter. These pains should all be distinguished from peripheral neuritis by their transient character, and from true neuralgic pains by their tenderness to pressure and by their causing muscular stiffness. In a few instances the joints—especially the wrist, knees, and ankles—became painful, when the differentiation from rheumatism became more difficult, and it was only the presence of other symptoms of Graves' disease which served to distinguish them. From gouty arthritis they can be distinguished by the absence of the painful points on the condyles.

Headache.—Among the commonest sensory disturbances of Graves' disease are headaches. With many patients they are almost of daily

occurrence, particularly in the morning. I was early struck with their migrainous character, especially when accompanied with nausea or other gastric disturbance. This was further borne out by the functional derangements of the eyes, which, though not assuming the definite teichopsia of migraine, yet flashes of light, dark and bright-colored spectra, and pain in the eyes are frequently mentioned. They differ from typical attacks of migraine in not coming on in severe paroxysms, followed by complete cessation for more or less prolonged periods, and they rarely lead to vomiting. In other respects they so resemble migraine that finally I was led to ask if the patients themselves had suffered from migraine previously to the development of Graves' disease, and whether they had migrainous relatives. The results of these inquiries were interesting. Out of the list of 36 with goiter who were questioned, 19 had suffered from migraine in previous years, 11 of them severely. Particulars as to relatives were noted in 14—1 (a man) had suffered greatly from migraine from boyhood and so did his father. The rest were women. One had a mother and sister who had goiter, and they, with three other sisters and a brother, were martyrs to sick headaches. Another had an aunt and a cousin on the mother's side who had goiter, and they, with her mother's whole family, were migrainous, but not her father's. Another, her mother and brother suffered with migraine. Two had each a migrainous sister, one a father very severely affected; one a father and a sister; one a mother and a sister. Of the remaining 12—3 men and 9 women—none were troubled much with headaches. One, however, had a mother who also had goiter and who had migraine badly. Another also had a mother with goiter, but in her case, and in 3 other patients, no family history of migraine could be elicited. Among the 28 cases without goiter, 18 cases are noted with headaches, 7 had suffered from migraine, and 3 had no headaches at all. Flashes of light and scotoma were mentioned in 4 cases with goiter; and mentioned in 8 cases of the patients without goiter. One woman, without goiter after the disease developed, when she was forty-two years of age had headaches for the first time and often attacks of blindness in the right eye. She had a sister who had goiter and who was very migrainous. Her mother, who suffered greatly from migraine, and finally died of a disease whose nature neither of her physicians (who were eminent New York practitioners) could diagnose, but which both this patient and her goitrous sister were now sure resembled their own malady. As to relatives, particulars were obtained in 8 of the cases without goiter. Four (1 man and 3 women) had each a sister with goiter, who also suffered from migraine. One

had two brothers who suffered from migraine, but her two sisters did not. One had a migrainous mother, but her three sisters were free. One (a man) had a mother, sister, and two brothers who had migraine. Two had migraine, but there was none in their families. This frequent association cannot be merely a coincidence, and, as we shall see, is not without its bearing upon the pathology of Graves' disease.

Vertigo is an occasional symptom, and was pronounced in 5 patients with goiter and in 5 cases without goiter. Though it might be expected to be connected with gastric derangement, yet I found it almost uniformly present in the characters of aural vertigo instead, being most pronounced in patients who suffered from tinnitus or loss of hearing. When severe, it had the character of aural vertigo, in causing a great sense of fright. The worst example of the kind occurred in a patient without goiter, who entirely lost her hearing in the left ear until she recovered from her disease, when the hearing returned and the vertigo ceased. In no one of the cases in whom abasia occurred was vertigo complained of.

Paresthesia.—As might be expected in a disease with so many nervous symptoms, various forms of paresthesia are common. Of these, tingling and numbness are the most frequent, and usually more pronounced in the lower than in the upper extremities. Of 42 patients with goiter, 10 complained of paresthesia. It is noticeable that numbness and tingling were frequently associated in time with headaches, thus bearing out the resemblance with severe migraine, in which these symptoms are likewise common.

Digestive Disturbances.—Much the most serious derangements in Graves' disease, for their effect upon the nutrition of the body, are those connected with the functions of the alimentary canal. It may be said that Graves' disease increases in severity, and becomes dangerous to life, in direct proportion to the degree in which the gastro-intestinal tract is involved. None of the other derangements, not even the tachycardia, and, least of all, the size of the goiter, seem so to tell upon the general health of the patient as the disordered condition of the stomach and intestines. The bearing of this important element upon the pathology itself of Graves' disease, as well as upon its successful treatment, will be discussed later.

The first fact to note about the digestive disorders of Graves' disease is that they are specific in their characters, and distinctively unlike other affections of the gastro-intestinal tract. In contrast to the variety in the symptoms of ordinary digestive derangements in different persons, the gastro-intestinal disorders of Graves' disease are

almost uniformly similar in their chief features, however the other symptoms of the complaint may vary between different individuals. Thus, from their earliest developments to their end, in fatal cases with uncontrollable vomiting and diarrhea, they never present the character of inflammatory, ulcerative, or of exudative processes. Moreover, whether in their slighter or in their severer forms, they are not amenable to the ordinary remedies prescribed for digestive disorders, thus confirming the inference that they are peculiar in their dependence upon this specific malady. The most significant fact, however, about them is that, with rare exceptions, they develop not during the course of the other derangements, but much before them. If careful inquiry on this subject be made, it is striking to find how generally the patients admit the presence of digestive symptoms, often for long periods before any of their other derangements.

Out of the entire list of my cases of both forms only 4 patients (2 with goiter and 2 without) stated that they previously had suffered from no trouble of either stomach or bowels. Two of these patients (1 with goiter and 1 without) subsequently had attacks of apparently causeless diarrhea. With 2 of my cases, both without goiter, their digestive troubles began so suddenly that they could give the exact date of their occurrence. In the majority, however, of both classes the story of their derangements was much the same throughout, as if the symptoms always remained the same in kind from the first, and not like the relapsing or changing forms of ordinary gastro-intestinal affections.

Characteristic Disorders of the Stomach.—Thus, as to the stomach, at no time is there any tenderness on palpation or any epigastric rigidity, as in gastritis, ulcerative or otherwise. With a number of my patients gastric lavage had been employed for relief of the symptoms, but the uniform report was that no mucus was found in any amount in the outflow, nor did the lavage afford relief. A common symptom was nausea, which, however, rarely led to vomiting, except in advanced cases. This nausea was sometimes extremely persistent, in 1 case without goiter continuing for fully two years before the tachycardia and the other derangements of the disease developed, as they did afterward to an alarming extent. This nausea usually has no relation to the time of eating, occurring as often with an empty stomach as after meals. A much more common symptom is gastric flatulence, which may persist even after gastric discomfort has subsided, but ordinarily it constitutes one of the most annoying accompaniments of the complaint. The patients may attempt to relieve it by

eructations, but uniformly deny that any acid or acrid sensation is produced in the throat or mouth if they succeed in the attempt. Instead of pain, or a sense of weight, or of cramps, they ordinarily describe their sensations as consisting of an ill-defined discomfort, referred to the stomach, which with many is very distressing.

In my list of 42 patients with goiter, 7 complained of frequent nausea, it was absent in 25, and not noted in 9. Among the 28 cases without goiter, nausea was present in 14 cases; absent or not noted in 14. Flatulence and gastric discomfort were present in 23 cases with goiter, and precisely the same symptoms were present in 21 cases without.

Characteristic Disorders of the Intestine.—Intestinal derangements, on the other hand, are not only both frequent and pronounced in Graves' disease, but they also seem to hold a fairly constant relation to the other characteristic symptoms. This is particularly true of the tachycardia, the nervousness, and the tremors, which are often aggravated with each exacerbation of the bowel derangement. Several patients asserted that attacks of nocturnal palpitation occurred only when the bowels became loose. The immediate reduction of the pulse-rate, as we shall see, by certain forms of intestinal medication would also appear to confirm this surmise. A sense of diffused distress throughout the abdomen, accompanied with flatulence, is even more common than the like symptoms just described in the stomach. With some this sensation is aggravated with every movement of the bowels, occasionally even when the movement seems to be regular and natural. The most characteristic symptom, however, is diarrhea.

It was present in 25 of the patients with goiter, and in 13 of those without. It was present in all 4 of the fatal cases, becoming uncontrollable in each one. The diarrhea of Graves' disease is as peculiar in its way as any other accompaniments of the affection. Its exciting causes are usually difficult to determine, for, though indiscretions in diet can be occasionally adduced, yet its onset seems often without any known reason. The only exception to this statement in my patients was that the indulgence in red meats, especially beef, was very commonly followed by return of the diarrhea in those who had been free from it after leaving off meats. The commonest time of onset is the latter part of the night or early morning, occurring irregularly afterward during the day, and not particularly apt to follow directly upon meals. The discharges are rarely preceded or followed by pain, are not usually offensive, but are watery and devoid of either blood, mucus, or pus. According to my experience, so long as the

diarrhea persists no headway is made in the treatment of Graves' disease.

On the other hand, a certain percentage of patients with Graves' disease never have diarrhea, but constipation instead. This was noted as habitual in 6 cases with goiter and in 10 cases without goiter. Among these patients, however, 7 with goiter and 4 without goiter had occasional attacks of diarrhea alternating with constipation. In every instance their diarrhea was stated to have occurred without any imaginable cause, and it was both painless and watery. In the cases with constipation, flatulence and a sense of discomfort were noted in 2 cases with goiter and in 8 out of the 10 cases without goiter. In 11 cases with goiter and in 6 cases without goiter the bowels were stated to be regular and normal in the movements. In all of these, however, the other symptoms of the complaint were moderate and the disease was only in a mild form or incipient stage.

Bulimia, or a sense of intense hunger, is mentioned among the symptoms of this complaint. It was very marked in 6 of my patients with goiter (2 men and 4 women); in 1 of the latter preceding the goiter by more than two years, as did in her case all the other symptoms—tachycardia, tremors, pains, etc. The commonest time for its onset was in the night. The same symptom was present in 5 cases without goiter.

Emaciation is a very notable symptom in the severe cases of this disease. As a rule, it is most pronounced in the patients who have suffered most from diarrhea. One of the worst cases among my patients, however, was a woman who had neither goiter nor diarrhea. She had to be padded to prevent the bones from cutting through the skin. She recovered wholly in time, and regained not only her full weight, but her physical strength, and lived an active life for over four years, when she had an acute relapse, and died suddenly from syncope. Emaciation was very pronounced in 17 with goiter and in 6 of the cases without goiter.

Insomnia.—Among the frequent complaints of Graves' disease is insomnia. We might naturally expect it to be from the extreme nervousness to which many of these patients are subject, but I am inclined to ascribe it more to their digestive derangements, as it has all the characteristics of the sleeplessness of chronic dyspeptics. Thus, the majority are more troubled with wakefulness after midnight than before, and often in proportion to the disturbance of the stomach and bowels. This insomnia is also but little relieved by soporific drugs, and improves only as the digestive disorders improve. Insomnia was

especially complained of by 21 patients with goiter and by 18 patients without goiter. In all cases in which the insomnia was pronounced the morning mental depression was naturally aggravated.

Loss of Hair.—Falling out of the hair is often an early symptom, and naturally more noticeable among women. They are, therefore, very certain of its occurrence and of its state, compared with that of other symptoms. It was noted in 21 cases of goiter and in 6 cases without goiter. In 1 case it included the eyebrows. The loss of hair is not permanent, for it soon grows again with the first signs of general improvement. In all respects it resembles the loss of hair after prolonged fevers, like typhoid, and indicates, therefore, a profound and general toxemia which involves every process of nutrition. One patient with goiter stated, that when the symptoms of acute Graves' disease developed upon a chronic goiter of thirty-five years' standing, her hair, instead of falling out, turned gray, and then returned again to its normal color when the acute symptoms had subsided.

Pigmentation of the Skin.—This frequently occurs in brownish-colored and discrete patches, but, though classed by a number of writers as a distinctive symptom of Graves' disease, I regard it as merely a sign of impaired nutrition, for it is quite similar to the discolorations met with in many wasting diseases and in chronic anemics. Its hue also varies, in some resembling the bronzing of Addison's disease. Its duration also is very variable.

Itching of the skin is quite characteristic of this complaint, more especially in severe cases. Like all other symptoms of Graves' disease, it has no connection with inflammation, being accompanied with neither redness nor eruption. It is apt to be most troublesome at night, increasing the insomnia by its shifting character. Scratching neither relieves nor aggravates it. It was noted in 13 cases with goiter and in 5 cases without. In no case among the women was it associated with pruritus vulvæ.

Sweating is a frequent symptom, and not always either nocturnal or indicative of an advanced condition of debility, for in some patients it occurred quite early in the complaint, before they had become much reduced; as in other conditions of hidrosis, it was variable, coming and going without any imaginable reason, but in no cases preceded by fever. In my lists troublesome sweating was reported in 7 of the goitrous cases and in 4 of the non-goitrous cases.

Vesical Irritability.—Irritability of the urinary bladder, causing frequent micturition, is a very common and troublesome complication, especially as it is more apt to occur at night, and thus aggravate the

insomnia and nervousness of the patient. In full keeping with the other symptoms of Graves' disease it has no connection with inflammation, and hence never presents the accompaniment of cystitis, the urine being free from mucus and pus. It was noted in 14 of the cases with goiter and in 10 of the cases without.

All Symptoms Worse in the Morning.—If it be asked what are the most peculiar or characteristic clinical features in Graves' disease, I would answer that, next to its specific tachycardia, is the morning exacerbation of its chief symptoms. No careful observer can fail to be struck by this singular phenomenon. In my notes, out of the 42 cases of goiter only 4 denied that they were worse in the morning, and it is doubtful if one of these (an Armenian woman, who could not speak English) understood the question. On the other hand, the remaining patients had no hesitation in admitting that they were always worse in the morning and better in the evening, and this statement is quite as distinctly present in the histories of the patients who never showed any change in the thyroid gland. Thus, of these 28 cases, morning aggravations were well marked in 25 and denied in only 3, and of each of these it might be correctly stated that the disease was still in an incipient stage. This characteristic of the disease is all the more exemplified when we pass from general conditions to particular symptoms.

Thus, as to the one symptom of muscular tremor. In no less than 6 patients with goiter, and 3 patients without, it was recorded that the shaking of the right hand prevented their writing in the forenoon, so that they had to wait until evening before they could hold a pen. One patient without goiter, not being accustomed to write at all, yet said that she could not sew in the morning, but could do so in the evening, but all other leading symptoms share likewise in this curious diurnal variation. Thus, the tachycardia, instead of being lessened by the night's bodily rest, is almost always increased in the early morning compared with the previous evening. The commonest time for palpitation is also toward morning. The headaches, as might be expected from their migrainous affinities, are far more common in the morning and worse in their onset, and in average cases they subside toward evening. Perhaps the most marked in their morning visitations are the periods of mental depression. Men, quite as much as women, will complain of their waking with a heavy weight on their spirits and a beclouding of the mind, wholly precluding any mental effort or concentration of thought, and then feel more like themselves at night. Those also who suffer from insomnia often find that they can go to sleep readily, but after midnight grow obstinately wakeful.

It is, however, with patients who have diarrhea that this complication is the most uniformly worse as morning approaches. The first onset of this symptom also in those who before have been free is scarcely ever in the daytime, but in the early morning. When diarrhea occurs it is noteworthy how, along with it, increased tachycardia, palpitation, and nervous depression occur, and too uniformly to doubt that at this period there must supervene a marked increase in the specific toxemia of the disease. An analogous aggravation of symptoms in the early morning is common in melancholia, and in those ill-defined nervous derangements now classed under the elastic term "neurasthenia." But in melancholia this feature is by no means so uniform as in Graves' disease, while I do not doubt that many cases of so-called neurasthenia are really examples of unrecognized Graves' disease. This morning element can only be ascribed to derangements in vital chemistry, but whether that can be explained by the increased activity of the thyroid gland after midnight will be discussed under the head of Pathology.

Chronicity.—There is one element in Graves' disease which, when duly considered, fully demonstrates its distinct and specific nature, and that is its chronicity. With all its multitudinous developments in deranged functions it remains the same throughout a long course and never merges into anything else. All its chief symptoms preserve the same characteristics, however long they continue. Thus, its tachycardia continues through months and years, as no other tachycardia ever does, with meantime surprisingly little change of any other kind in the overacting organ. But the tachycardia is not an isolated phenomenon in Graves' disease, instead it is uniformly accompanied by a characteristic train of other symptoms, which are as much a part of the malady as it is, and which also continue with little variation and little modification. The gastric derangement never becomes a gastritis nor the diarrhea an enteritis or a colitis.

My own experience leads me, therefore, to hesitate in pronouncing any patient cured who has had Graves' disease fully developed until a long time has elapsed after apparent recovery. Instead, I always tell patients that they must expect to keep up their treatment for at least two years before they can be sure of complete recovery. On that account I am skeptical of some reported rapid cures after certain procedures, especially surgical ones, as I want to know more of the after-history of the patients. A certain proportion improve, or even recover spontaneously, but I have found that relapses are common, sometimes after intervals of years. Most of the observations which I have read

of any kind. In some the heart walls are found postmortem more or less degenerated, but not more so than the texture of other organs, which suffer alike from the widespread derangement of nutrition which precedes death in this complaint.

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These pains, moreover, may affect the muscles of both the upper and lower extremities quite extensively. One case, a lady, for two years before goiter developed was greatly annoyed with nocturnal pains in the anterior aspect of both thighs; and the same kind of pains occurred in 1 case without goiter. These pains should all be distinguished from peripheral neuritis by their transient character, and from true neuralgic pains by their tenderness to pressure and by their causing muscular stiffness. In a few instances the joints—especially the wrist, knees, and ankles—became painful, when the differentiation from rheumatism became more difficult, and it was only the presence of other symptoms of Graves' disease which served to distinguish them. From gouty arthritis they can be distinguished by the absence of the painful points on the condyles.

Headache.—Among the commonest sensory disturbances of Graves' disease are headaches. With many patients they are almost of daily

bears no relation to the degree of thyroid hypertrophy, if that be taken as an index. The thyroid enlargement, when it occurs, is wholly unlike parenchymatous goiter, in being variable in every respect, increasing or diminishing, or even disappearing, with little or no correspondence with the general symptoms. In practice I pay no attention at all to the thyroid, and never prescribe for its enlargement, and expect it to disappear of its own accord after treatment of wholly different functions. Moreover, this theory fails altogether to account for the clinical fact, which I have now sufficiently demonstrated, that Graves' disease may occur without any sign of implication of the thyroid gland, while the general toxemia is as great, and may be as fatal, as in many patients who have goiter. These cases, therefore, cannot be regarded as in any sense incomplete or abortive forms of this very specific malady, and imply, instead, that implication of the thyroid is a secondary and not a primary element in the etiology of the affection.

Treatment.—There is scarcely any specific malady whose symptomatic treatment is so unsatisfactory as that of Graves' disease. If the case be really severe, it will be found that the tachycardia is wholly uncontrollable by the usually prescribed remedies for cardiac disorders, whether of a strengthening or of a sedative kind. The nervousness is not allayed by bromids. No ordinary prescriptions for dyspepsia relieve the gastric distress of flatulence. The diarrhea is not checked by astringents nor the insomnia helped by soporifics, while the emaciation continues progressive and the weakness grows apace despite all restoratives.

Such conditions prove that one specific, underlying cause is the common origin of the whole array of symptoms, and so long as that specific cause is not dealt with the separate treatment of resulting symptoms necessarily can be of no avail.

It was an unmistakable demonstration of the effect of diet in a serious and ultimately fatal case of Graves' disease which first led me to suspect that the toxemia had its origin in the gastro-intestinal tract. This patient, after every remedy—medicinal or otherwise—ordinarily prescribed for Graves' disease had been tried without success, began to improve at once, until she apparently recovered on being restricted to the use of fermented milk instead of meat. She then resumed the meat diet and forthwith relapsed. Discontinuing the meat, and resuming the milk, she rapidly improved again. She then refused to continue the use of milk and returned to meat, with the result that her malady became uncontrollable, and soon ended in death. The relation of cause and effect in the quality of her food, as regards both improvement

and relapse, was as clearly shown as could be desired in any instance of the disease.

The dependence of the entire train of symptoms of Graves' disease, not upon any state of the thyroid, but on what is ingested in the alimentary canal, may be experimentally tested any time. Let a patient with a temporary improvement in the symptoms partake heartily of beef three times a day, particularly at night, and immediate relapse will occur. Every one of the characteristic disorders will be as surely aggravated as those of a diabetic upon a free indulgence in starches. Taken as a whole, my experience is that really developed cases of Graves' disease without exophthalmic goiter are more difficult to treat than those with goiter.

It is always advisable to impress upon the patients in the beginning that their malady, when fully established, is not easy to cure, and that they will have to continue in the course recommended for at least two years, whatever improvement has been secured. Most patients of ordinary intelligence can be made to see that all derangements of digestion, if they have continued for any length of time, will then require time to correct. Any diarrhea, for example, whatever its original cause, which has lasted two years cannot be expected to cease without prolonged attention to dietetic rules, as well as to remedies to prevent relapses. Hence, in any disease characterized by so many different disorders as Graves' disease, nothing short of the utmost perseverance in a systematic course of treatment will insure ultimate recovery. I have always found that relapses recur only after the patients have violated instructions about diet. Diet, therefore, ranks first in importance in the treatment of Graves' disease. Everything else should be regarded as subordinate to that of diet. When the disease has got a firm hold on the patient, if he continues to eat freely of red meats, such as beef, veal, mutton or pork, nothing becomes plainer than the futility of drugs. For, so long as the poison is formed in the digestive tract, and then absorbed into the blood, what follows is a paralysis of all vasoconstrictors throughout the body, the arterial system everywhere relaxing, and the whole train of vascular nervous and secretory symptoms characteristic of Graves' disease developing as a consequence.

As milk constitutes much the safest food for this disease, enough to be by itself sufficient to cure many cases without any other treatment, its administration as a remedy merits more than a passing consideration. This fact is well known and acted upon by all races of men who have to live on milk as their chief article of food, such as the Bedouins,

the Tartars, the Guacos of South America, etc., who subsist on the milk of cows, goats, sheep, and asses. A Bedouin cannot be persuaded to drink fresh milk any more than we would eat raw potatoes. They always ferment milk first, for a very physiologic reason, as fresh milk has first to be curdled in the stomach before it can be digested. Any quantity of it uses up so much of the pepsin of the stomach that not enough then remains to dissolve the precipitated casein, and large masses of hard curds remain to disturb digestion, or, as many express it, they are made bilious by it. By artificially curdling it first the stomach is spared this process of digestion, and the ferment usually employed is the yeast plant. By some Tartar tribes the lichen called Kefir is used instead, and an excellent article is made by it.

Throughout western Asia and Egypt a piece of dough is put into the milk to make the first specimen, but after that enough of the fermented milk is preserved each day to add to the fresh milk. When so prepared it is doubtful if there be any more digestible or complete food, for milk contains every ingredient in its due proportion out of which the body may be built up, as the growth of all young mammalia proves. With this fermented milk I have been able to cure the most difficult of gastric disorders, particularly those characterized by vomiting. Even in cancer of the stomach I have known it to be borne when every other article of diet was rejected.

Anyone can learn to live largely on fermented milk, as is demonstrated on an extensive scale by its universal use in western Asia, Egypt, etc., and I have found most of my patients have become fond of it. Others, however, assert that they cannot bring themselves to continue its use, and many have used instead milk peptonized by Fairchild's peptonic powders. Others get along with milk diluted with an equal part of Vichy or lime-water. Milk and cream can also be used freely with cereals, and is all the better digested if sweetened with sugar in moderate quantities.

Poultry is usually well borne, provided it be not kept too long. Fish is allowable, excluding, however, the more oily kinds. Boiled fish is usually more difficult of digestion. Oysters, as a rule, agree well. No more than two eggs should be taken in a day. Bread is an excellent article, and may be taken freely with butter, but in all cases should be as crusty as possible. Of the cereals, oatmeal in any form should be avoided, but hominy, well boiled, and rice are good. Of the vegetables, beans and peas are injurious, but string beans may be taken freely. Asparagus, tomatoes, beets, carrots, and spinach are to be avoided. I have found potatoes generally well borne. When diarrhea is per-

sistent the use of vegetables should be restricted until the looseness of the bowels subsides. Cooked fruit is almost always well digested, but uncooked apples, pears, and plums are likely to cause diarrhea. Pastry and cakes should be excluded, though I have found that light loaf gingerbread taken with milk agrees very well with many, perhaps on account of the ginger being a good intestinal antiseptic. The preparation called Mellin's Food, taken in hot milk, often relieves the morning headaches, and may be taken at other times, between meals, when the patients feel weak or exhausted. All fermented alcoholic liquors should be avoided and only spirits allowed in moderation, and never on an empty stomach.

The proper medicinal treatment of Graves' disease affords one of the most conclusive proofs of the gastro-intestinal origin of the malady.

Thus, the heart quiets down immediately after the action of a mercurial cathartic. I have repeatedly known the pulse to fall 40 beats after a single blue pill had been taken. My notes on this point are as follows: Whole number of cases with goiter, who took mercurial laxative once a week throughout treatment, 18. Improvement in all except 1, who declined to take it on account of the effect on her teeth; whole number of cases without goiter, 20, and relief failed only in 1 case. It is equally noteworthy that the beneficial action of mercurial laxatives is not restricted to its first employment, but continues upon its use for months and years, the patients reporting that they felt better after taking it throughout their entire illness. The presence of diarrhea instead of counterindicating mercurial laxatives, is relieved by them with far more certainty than by any astringents.

The only explanation why a mercurial laxative can so favorably affect a persistent overaction of the heart, and relieve mental depression better than any stimulant, and calm nervousness and tremor, is that mercurial laxatives are among our best established intestinal antiseptics. I have yet to meet with a case of Graves' disease in which their administration aggravated any condition in the patient. With most patients I prescribe the 5-gr. blue pill, taken at night, followed by a saline in the morning. It is very common for the patients to say that they feel the benefit of the mercurial more on the second day than on the first after taking the dose. To many patients I prescribe the mercurial twice a week, while with others once a week. Occasionally castor oil seems to act better than a mercurial cathartic. This can be found out only on trial. In some cases of insomnia 1 gr. of calomel with 2 teaspoonfuls of compound licorice powder, taken at bedtime, acts as an excellent soporific. Marked general weakness does

not contra-indicate the use of these cathartics, owing to their counter-acting the primary cause of the systemic prostration.

Gastric flatulence and discomfort are symptoms which often continue to be very obstinate and persistent. The whole list of vegetable bitters may be discarded, including *nux vomica* or strychnin, nor are the mineral acids of much use. Pepsin is equally disappointing and likewise charcoal. Gastric lavage I never prescribe, for many of the patients who have come to me have had this procedure faithfully tried before, with the invariable story that no mucus was brought away by the washing, and that they felt worse after its employment. As it is a constant characteristic of Graves' disease that its various visceral derangements have no inflammatory element connected with them, the failure of different measures often used in other forms of gastric disorders is not surprising. Resorcin often benefits this flatulent condition, though not as markedly as it does in gastritis.

Among our intestinal antiseptics, bismuth must always take the first rank. I have found its combination with phenol derivatives especially useful. Such preparations as 10 gr. of phenol bismuth or naphthol bismuth, with the same quantity of sodium benzoate in two capsules, taken an hour after meals and on retiring, have been administered to numerous patients with benefit for months at a time.

There may be no question, also, of the great value of the salicylates in Graves' disease, as both the sodium salicylate and the sodium benzoate are efficient cholagogues. I have been accustomed to give 10 gr. of each, in capsules, an hour after meals, in the treatment of migraine as a prophylactic.

The sodium phosphate in quite a proportion of patients seems to assist their digestion, taken in doses of $\frac{1}{2}$ dram just before eating.

Surgical Treatment.—Of recent years very favorable results have been reported, particularly by the Mayo brothers, of Rochester, Minn., of the curative effects of a partial resection of the thyroid gland in cases of exophthalmic goiter. While I do not doubt the reports of such favorable results, I cannot account for them. The partial resection of the liver in a case of cirrhosis, or of any other organ of the body affected by organic changes, never produces either amelioration or cure. Nor can I see how such a procedure could be of benefit in Graves' disease. In advanced or severe cases of this complaint any surgical operation is dangerous. Moreover, we should have statistics showing the permanence or otherwise of the effects of such surgical treatment.

If the thyroid gland spontaneously hypertrophies, and causes Graves' disease by consequent excess of its secretion, it would stand absolutely alone among diseases. No gland ever secretes anything spontaneously. There is always some antecedent cause to secretion, whether in the blood or in the tissues. Thus, salivation by the parotids does not happen without the previous presence of mercury in the blood. But what is the antecedent of so-called thyroidism in Graves' disease? That there is such an antecedent in Graves' disease we have demonstrated to be found in the genesis of a blood poison in the intestines. This poison may or may not cause hypertrophy of the thyroid gland, and hence present us with cases of Graves' disease with or without exophthalmic goiter.

CHAPTER XIII

DISEASES CAUSED BY ANIMAL PARASITES

CESTODES, OR TAPEWORMS

WE have already, in the article on Hydatids, shown how widely dispersed in the animal vertebrate kingdom the cestodes or tapeworms are distributed. But, although in their second generation, some varieties of them may grow from twenty to thirty feet in length, they rarely produce any serious symptoms, and their presence is revealed to the patient only by more or less lengthy portions of the worm being passed by the bowels. These received the name of tapeworm from their resemblance to pieces of tape, from which, however, they differ, as they are divided into segments whose length and size vary in different species. These segments become smaller and smaller as they approach the head of the worm, which has attached itself firmly to a fold of the intestinal mucous membrane.

It is not until the head itself has been expelled that the patient can be pronounced free from this parasite. As before remarked, different species of tapeworm are found in different animals, many of them being rare in the United States, where the commonest form comes from eating beef. I found the *Tænia saginata* very common in Mediterranean countries, from the practice of the natives eating uncooked meat. This form is also the commonest in the United States. Another species, called the *Tænia solium*, comes from pork, and is prevalent in Germany from the consumption there of sausages. The largest of tapeworms, however, is called *Bothrioccephalus*, and is common in Finland and Japan from eating raw fish.

As the first generation of these parasites consists of very small sacs, which have found their way to the muscles from the intestines, they are called cestodes.

One form, *Tænia larvo-punctata*, has its larvæ developed in butterflies and in beetles. A curious allied form to this species is often found in shallow pools of water, when the full-grown worm, called *godius*, resembles, as it swims in the water, a live horsehair. The eggs of this *godius* are attached to each other, and form long strings wound round weeds in the side of the pool, looking there like tufts of cotton. As they exist

in immense numbers, the singular survival of the species is explained, for that survival can occur only by a single egg penetrating and developing in the thigh muscles of a grasshopper. This can happen only when the pool has dried up, so that a grasshopper can jump upon the place and thus get an egg attached to the thigh. As these insects, in turn, may die in water, the larvæ of the *godius* may be thus set free.

Treatment of Tapeworm.—The first indication on this subject is prophylaxis. This is done, particularly in Germany, by a well-organized staff in the abattoirs of the large cities, which inspects the carcasses of hogs, sheep, and beeves for the discovery in meats of the cysticerci. When about one in 6 per cent. of the carcasses of hogs are found infected the pork is then called measly from its appearance. Analogous alterations are found in infected beef and mutton. Unfortunately, we do not have similar inspections made in the United States except in cases of cows suspected of tuberculosis.

The eating of meat infected by cestodes leads to the development and growth in the intestines of the various species of tapeworm. Although the full-grown tapeworm does not seriously interfere with the health of the persons affected by them, yet the knowledge of their presence often so worries them that they become very apprehensive and insist upon their removal. For this purpose we have a number of remedies, the agent most commonly used being the ethereal extract of *Filix mas* or male fern. To secure its best action, the patient should live upon very light or milk diet for two days, and then, in the morning, on a fasting stomach, take 2 drams of the ethereal extract of *Filix mas*, followed in two hours by a dose of 5 gr. of calomel with 40 gr. of compound jalap powder. When the bowels have acted a diligent search should be made for the head of the worm. Meantime, whether the head be found or not, what has been brought away of the tapeworm should be burned, and not thrown down the water-closet, because the eggs are not only very tenacious in their vitality, but may live for at least twenty days outside the body and be the means of infecting other animals. We have, however, other agents which are more or less effective against tapeworm, the chief of which, in my experience, are pumpkin seeds. Next to these come infusions of the bark of the root of the pomegranite. In taking the pumpkin seeds, 3 or 4 oz. should be bruised and then macerated for twelve or fourteen hours. The entire quantity should be taken, followed by an efficient purge. An infusion of the bark of the pomegranite root is a very efficient remedy—3 oz. may be macerated in 10 oz. of water and boiled down one-half. The whole quantity may be given in divided doses, to be followed in an

hour by a purge. The active principle of the root pelletierin is now much employed. It is given in doses of 6 to 8 gr. with 5 gr. of tannin, in sweetened water, followed in an hour by a purge. In obstinate cases we may try a combination of these vermifuges—namely, pomegranate root, $\frac{1}{2}$ oz.; pumpkin seeds, 1 oz., powdered ergot, 1 dram, and boiling water, 10 oz.; an emulsion of 1 dram of ethereal extract of Filix mas, made with acacia powder, 2 min. of croton oil are added. The emulsion and infusion should be mixed and taken fasting in the morning. It is well in all cases to clear the intestines previously by 1 oz. of Epsom salts, taken for two mornings.

HYDATIDS, OR ECHINOCOCCI

Hydatids, when found in the bodies of men or other animals, appear as cysts or bags of fluid, which give no intimation of their true origin. These cysts may be very large, so that by their mere mechanical presence they cause dislocation of important organs of the body. It is only by the prolonged researches of pathologists that the true nature of these virtually animal parasites was demonstrated. Because their origin is from a minute worm, attached to the inner folds of the intestine of a dog, these worms are classed among the tenia, and, therefore, belong to the same general class as the tapeworms, whose parasitic presence is so wide in the animal kingdom. As tapeworms develop to such an extent in the intestines without any visible antecedents they were at first ascribed to spontaneous generation, but further researches showed that most animals had their own kind of tapeworms. It was at this stage that Von Siebald discovered that owls and cats had the same kind of tapeworm, and he inferred that this was because owls and cats lived on the same diet—namely, mice. Thereupon he examined the bodies of mice, and found that many of them were infected by minute parasites, which lived in the form of small sacs in their bodies, especially their muscles. He, therefore, fed dogs with the flesh of these mice, with the result that these dogs developed in their intestines the same tapeworm which grew in owls and in cats. This was a notable scientific discovery, because it established the great law of alternate generation in the animal kingdom, often illustrated in our own species, where children frequently resemble their grandparents more than their parents. In this case, the first generation was a little sac in the muscles of a mouse, while the second generation, having no resemblance to the little sac, grows into a long tapeworm.

We are, therefore, now better enabled to understand what the origin of hydatids is. They begin with a minute worm, found only in

the intestine of the dog, which is called *Tænia echinococcus*. This is a tiny cestode, not more than 4 or 5 mm. in length, consisting of three or four segments, of which the terminal one alone is mature, and has a length of about 2 mm. and a breadth of 0.6 mm. The head is small and provided with four sucking disks and a rostellum with a double row of hooklets, which are closely adherent to the inner lining of the small intestine of the dog. The ripe segment contains about 5000 eggs, which attain their development in the solid organs of the infected animal.

The little six-hooked embryo, fed from the eggshell by digestion, burrows through the intestinal wall and reaches the peritoneal cavity or the muscles. It may enter the portal vessels and be carried to the liver. It may enter the systemic vessels and be distributed to any part of the body. It will, therefore, cause symptoms according to where it is lodged; thus, one of the most serious of its results is when a hydatid is lodged and grows in the brain, causing then all the symptoms of brain tumor. But the commonest place of development is in the liver.

Once having reached its destination, it undergoes the following changes: the hooklets disappear, and the little embryo is gradually converted into a small cyst, which presents two distinct layers, an external, laminated, cuticular membrane or capsule, and an internal, granular, parenchymatous layer, the endocyst. The little cyst, or vesicle, contains a clear fluid. There is more or less reaction in the neighboring tissues, and the cyst has, in time, a fibrous investment. When this primary cyst has attained a certain size buds develop from the parenchymatous layer, which are gradually converted into cysts, presenting a structure identical with that of the original cyst.

We are particularly interested in the inner or parenchymatous layer, because from it, by a process very similar to budding, spring the numerous daughter-cysts, which are constructed like the parent cyst, and may, if set free, produce just the same results.

In the United States an original case of hydatids is very rare. Out of 241 cases reported by Lyon (in 1902) only 1 was a native American. In my own hospital experience I met with only 1 case, in a German woman, who applied for admission on account of intractable vomiting. On examination of the vomitus a number of the hooklets of the echinococci were found. In her case this hydatid had grown in her liver until, by an inflammatory process, it adhered to and perforated into the stomach. The only other cases which I have seen were in two ladies who, while in Europe, were accustomed to caress and fondle their pet

dogs. They both developed hydatids in the liver. One of them was cured by incision and emptying of the sac, but in the other case an abscess formed and burst externally.

The prevalence of this infection is greatest in countries like Ireland, where dogs constantly live in the same huts with their owners, and also in Australia, where dogs are used for sheep herding.

Treatment.—The only treatment is, first, to settle the diagnosis by aspirating some of the liquid of the tumor and finding in it the hooklet of the echinococcus. The sac should then be freely opened and treated on the ordinary principles of surgery.

TRICHINIASIS

This singular invasion of the muscular tissues of the human body by the embryos of the *Trichina spiralis*, a worm originally derived from swine, occurs in the United States among German immigrants, who are accustomed to eat ham or sausages which are not thoroughly cooked. I have met with a number of such cases, and in every one of them the diagnosis, which otherwise might have been difficult, was suggested by the remarkable increase of the eosinophiles among the white corpuscles of the blood. Normally, the eosinophiles do not rise much above 2 per cent. of the leukocytes, but in my cases the proportion was between 20 and 30 per cent. Cases have been reported of the eosinophiles being over 60 per cent. of the leukocytes. Why the remarkable increase in this variety of leukocytes should occur so specifically in this infection is unknown. It is possible that it is due to poison secreted by the worm embryos in their transit from the small intestine to the muscles.

This parasite was identified by Tiedman in 1822 and by Hilton in 1832, and first named by Richard Owen. As above remarked, its original habitat is in pork, which in Germany leads to official inspection of all such meat in the abattoirs.

This worm first develops in the small intestine, and may there give rise to its first symptoms which, in some cases, may be so severe from the accompanying diarrhea and vomiting as to suggest cholera morbus. While sojourning in the small intestine the female worm produces crowds of embryos, which, by means of the hooks about their mouths, penetrate the walls of the intestine and make their way to the muscular tissues, where these larval forms grow and usually become encysted. It is due to their presence in the muscular system that the symptoms of the disease develop. These at first might easily be mistaken for muscular rheumatism, because the muscles become tender both on

movement and on pressure. When this infection is at all general the symptoms become serious; thus, implication of the diaphragm may directly occasion severe dyspnea. Fever is a very common accompaniment, which occasionally is so intermittent as to suggest malaria. Ordinarily, however, the symptoms appear more like those of typhoid fever, causing great prostration, with dryness of the tongue and febrile pulse. Examination of the blood will at once settle the diagnosis. The further course of the fever is very prolonged, leading to emaciation and death from intercurrent complications. The excision of a piece of muscular tissue during life, whether from the deltoid or the gluteus, will reveal the presence of the encysted trichinæ.

Treatment is of no avail during the early stages, while the worms infest the small intestine, giving rise to the symptoms which we have described. Then a dose of turpentine, $\frac{1}{2}$ oz., combined with 1 oz. of castor oil and 5 gr. of thymol, should be given on an empty stomach. This may be repeated once a week for three weeks. The worms may be discovered in the stools, which should be spread on a glass plate or black background and examined with a low-power lens, when the trichinæ are seen as small glistening silvery threads. For the encysted embryos in the muscles themselves we have no treatment.

Dr. R. C. Kemp, of New York, has told me that he has cured a case of trichina by persevering in doses of urotropin, from 40 to 80 gr. a day, which killed the parasites *in situ*.

ASCARIDES

There remains for our consideration two forms of intestinal worms, the *Ascaris lumbricoides*, or long round worms, and the *Oxyuris vermicularis*, or pin-worms.

They differ altogether from the tenia, in that their life-history is exclusively in the intestine. Both forms may infect grown persons, but the rule is that they occur in children. The round worms are pointed at each end, and usually of a reddish color. Ordinarily, they are either single or few in number, but they may occur in such numbers as to produce a great variety of troublesome symptoms, otherwise the patient may not be aware of their presence until he passes one from his bowels. The usual seat of development is in the upper part of the small intestine, but many cases are reported of their wandering upward into the pharynx or even into the Eustachian tube. When they occur in large numbers in the intestines they may produce a great variety of nervous symptoms, such as twitching of the muscles during sleep or picking of the nose and grinding of the teeth. Parents are

apt to ascribe many forms of illness to their presence, but ordinarily they occasion very few really morbid symptoms.

Treatment.—Almost any active purgative, especially calomel and castor oil, will dislodge these worms, but the specific for them is santonin. Santonin may be given, mixed with sugar, in doses of from $\frac{1}{4}$ to 1 gr. for a child and 2 or 3 gr. for an adult, followed by calomel or a saline purge. The dose may be given for three or four days. An unpleasant consequence which sometimes follows the administration of this drug is xanthopsia, or yellow vision, but which is of no serious import, for it soon disappears.

OXYURIS VERMICULARIS (PIN-WORMS)

These worms are very common sources of annoyance to children. Their habitat is in the rectum, but I have known of their extending throughout the colon in the case of a man. In children they are apt to occasion much itching about the anus, especially at night, and thus interfere with sleep. Their treatment is entirely local, consisting of enemata, which should be given the child while lying on its back and with the hips elevated. The enemata may consist simply of normal saline, a teaspoonful of salt to a pint of water. Much the most effective agent, in my experience, is to make an infusion of $\frac{1}{4}$ oz. of pieces of quassia wood to the pint of water. Medicines or vermifuges by the mouth need not be administered.

ANKYLOSTOMIASIS (HOOKWORM DISEASE)

This disease, which is caused solely by a worm which infects the intestine, is one of the widest spread affections. It prevails in the southern districts of the United States, in parts of Europe, as in Germany, Belgium, France, and Hungary, particularly among miners, and especially in Porto Rico, India, and the Philippines. Recent studies of its prevalence in Porto Rico have shown that the larvæ of this worm first creep up the leg below the knee, often causing a troublesome itching of the skin which they traverse, producing at first a vesicular eruption and then pustules form with a sticky exudate, sometimes with much swelling of the skin, and then take a route through the blood until they reach the intestines, where they develop.

No other infection is known which takes such a specific and circuitous route in its course. There are two chief forms, the *Ankylostoma duodenale*, the Old World species, and the *Necator americanus*, the New World species. The ankylostoma is a small cylindric nematode, the male about 10 mm. and the female from 10 to 18 mm. in length. The

mouth has chitinous plates, and is provided with two pairs of sharp, hook-shaped teeth with which they pierce the mucosa of the bowel. The male has a prominent, umbrella-like caudal expansion.

The disease is propagated by numerous eggs of the worm, and the larvæ, after escaping from the eggs, may live for months in the mud or water of the mines, and they pass through a series of moults before they reach what is called the ripe stage. At this time, besides great tenacity of life, they show a marked tendency to wander. The numbers of these eggs is extraordinary, estimated at 4,000,000 in a badly infected person, and they are readily detected in the intestinal passages.

The route from the skin to the intestine, first demonstrated by Looss and confirmed by many others, is from the veins to the heart and thence to the lungs, in which they escape from the pulmonary vessels, pass up the bronchi and trachea, and so to the gullet, stomach, and intestines.

Pathologic anatomy shows that it is the upper part of the intestine, and particularly the jejunum, which is affected by these blood-sucking worms, who also, like leeches, seem to secrete a substance which prevents the coagulation of the blood. The clinical symptoms are then those of anemia from chronic hemorrhage with fatty degeneration. The injury to the mucous membrane of the intestine may also allow auto-intoxication to occur.

Very naturally, in localities where the hookworm disease prevails, may be found many individuals suffering from all the constitutional effects of chronic anemia, such as incapacity for any continued exertion. In children especially the normal growth may be much interfered with, while the hemoglobin falls from 40 to 50 per cent. and in several cases 75 per cent. The patients then become incapable of any exertion, and have to take to their beds, often dying with the symptoms of pure asthenia.

Digestive disturbances not uncommonly occur, accompanied, as in some cases of chlorosis, with perversions of appetite, so that they eat earth, paper, or clay; the dirt-eaters of the Southern States are all subject to the hookworm disease.

The diagnosis of this complaint is easy, by finding the eggs in the feces. The eggs are characteristic structures, usually containing four or eight segments, sometimes the complete embryo nearly ready to burst its shell.

One of the most important prophylactic measures is to wear shoes and stockings, but in all warm countries this is a very difficult procedure to adopt for children.

Treatment.—We have one specific for this dangerous infection, that is thymol. A saline purgative should be taken first at night, of which the best is the sulphate of magnesia. The thymol should be graduated according to the age of the patient, the dose for a child under five being 7 gr., divided into two capsules. The next morning after having taken the purgative the night before, one capsule of thymol may be taken at 6 A. M. and the second at 8 A. M.; two hours afterward the saline purgative of the night before should be repeated. For adults the thymol has to be given in large doses, preferably, therefore, in capsules which may contain 10 gr. each, and may be taken at intervals of ten minutes, until 60 gr. have been taken; two hours after the last dose the saline purgative should be again taken. This treatment should be carried out on one day of each week, until the patient is cured.

BALANTIDIUM COLI

This parasite is of several species which infest the intestines, the most important of which is the *Balantidium coli*, which is responsible for dysenteric symptoms, notably in the Philippines, as reported by Musgrave. It is oval in form, 70 to 100 mm. long, and 50 to 70 mm. broad, which, although it may penetrate the mucosa and submucosa, yet does not extend outside of the bowel, though it may be the cause of pronounced dysenteric symptoms.

The **treatment** of this parasite should be that of amebic dysentery, with full doses of ipecacuanha. Thymol, given in two capsules of 5 gr. each on rising in the morning, may also be tried.

DRACONTIASIS (GUINEA-WORM DISEASE)

This parasitic worm enters the system by drinking water which contains it. While it prevails widely in Africa, it is also reported in India, and even in the United States, doubtless as a foreign importation. Cases have been reported in Philadelphia and elsewhere in our country, so that it must now be admitted as a naturalized species.

When it has entered the stomach it traverses the small intestine, and after an uncertain sojourn there it penetrates the tissues, and may be felt under the skin, like a bunch of strings, then proceeding down the leg, until it reaches the feet; there it forms a vesicle, in which its head protrudes. When recognized it has to be very carefully extracted and wound round a smooth piece of wood, like a pencil, care being taken not to break it until it is all drawn out, because if broken it sets up serious inflammation.

Treatment.—Free doses of asafetida are said to destroy the worm.

FILARIASIS

There are various kinds of filaria; one form of filariasis, the *Filaria bancrofti*, has already been referred to under the head of Chyluria. (See page 449.)

There is, however, a form that appears only in the day, and that is the *Filaria diurna*. This form, however, is rare.

Similar filaria, such as *Filaria perstans*, have been described, but are rare except in certain countries. Daniels and Ozzard have shown the extraordinary prevalence of such filaria among the aborigines in British Guiana, where they estimate that 58 per cent. of the aborigines are infected.

OTHER NEMATODES

Under the head of animal parasites, we need refer only cursorily to a variety mentioned in medical literature, of which all are rare in this country.

Osler mentions some of the less important parasitic worms, among which are the *Filaria loa*, a cylindric worm of about 3 cm. length, whose habitat is beneath the conjunctiva. It has been found on the West African coast, in Brazil, and in the West Indies. *Filaria lentis* has been found in the crystallized lens of the eye, three specimens having been found together there. *Filaria labialis* is another kind found in a pustule in the upper lip. *Filaria hominis oris* has been described by Leidy as occurring in the mouth of a child. *Filaria bronchialis* occasionally develops in the trachea and bronchi. This parasite has been seen in a few cases in the bronchioles and in the lungs. There is no evidence that it ever produces an extensive verminous bronchitis similar to that which has been described in dogs.

Trichocephalus Dispar (Whip-worm).—This parasite is not infrequently found in the cecum and large intestine of man. It measures from 4 to 5 cm. in length, the male being somewhat shorter than the female. The worm is readily recognized by the remarkable difference between its anterior and posterior portions. The former, which forms at least three-fifths of the body, is extremely thin and hair-like in contrast to the thick hinder portion of the body, which, in the female, is conical and pointed, and in the male more obtuse and usually rolled like a spring. The eggs are oval, lemon shaped, .05 mm. in length, and each is provided with a button-like projection.

The number of the worms found is variable, as many as a thousand having been counted. It is a widely spread parasite. In parts of Europe it occurs in from 10 to 30 per cent. of all bodies examined, but

in the United States it is not so common. In 285 West Indian workers at Panama, Darling found 46 per cent. infected. It is possible, he thinks, that these parasites play a rôle in amebic dysentery, the lesions of which begin at the exact location of the points of their attachment. The trichocephalus rarely causes symptoms. French and Boycott found ova in 40 of 500 Guy's Hospital patients. They found no etiologic relationship of the parasite to appendicitis. Several cases have been reported in which profound anemia has occurred in connection with this parasite, usually with diarrhea. Enormous numbers may be present, as in Rudolph's case, without producing any symptoms.

The diagnosis is readily made by the examination of the feces, which contains, sometimes in great abundance, the characteristic lemon-shaped, hard, dark-brown eggs.

Strongyloides Intestinalis.—This parasite was discovered in 1876 by Normand, and is the same as was formerly described as *Anguillula stercoralis* and *Rhabdonema intestinalis*. It is a common parasite in tropical diarrhea, particularly in Cochin China. It is found in about 3 per cent. of the medical patients in the Isthmus of Panama, and in from 20 to 30 per cent. of the patients in the insane division. When in large numbers they cause diarrhea, but from his studies there Darling concludes that they are not the cause of severe diarrhea, though they may produce moderate anemia. The mother worm burrows in the mucous membrane and deposits ova. The parasite is found in the upper part of the small intestine. They are met with occasionally in temperate regions.

PARASITIC ARACHNIDS

Scabies.—Under the head of arachnid insects we would mention the acarus, because of the familiar scabies or itch so common in schools and institutions.

It produces so much itching that the whole body may be covered with marks from the effects of the scratching.

I have one remedy for this which is both rapid and efficacious. The remedy is prepared by boiling 1 part of quick-lime with 2 parts of sublimed sulphur in 10 parts of water until the two are perfectly united. During the boiling it must be constantly stirred with a stick of wood, and when the sulphur and lime have combined the fluid is to be decanted and kept in a well-stoppered bottle. A pint of the liquid is sufficient for the cure of several cases. It is enough to wash the body well with warm water, and then to rub the liquid into the

skin for half an hour. As the fluid evaporates, a layer of sulphur is left upon the skin, and during the half-hour the acarus is killed and the patient cured. It is only needful then to wash the body well and to wear clean clothes. The chief point in this plan is the ready absorption of the remedy, and consequently the more certain and quick destruction of the insect by using sulphur in a fluid form.

This application is equally efficacious against the ticks, popularly called jiggers, in the Southern States. These insects burrow under the skin and produce intense itching.

The *Dermacentor occidentalis* is present in the Northwestern States, from California to Montana. The bites may cause severe lymphangitis. It appears to be the medium of transmission of the Rocky Mountain spotted fever already alluded to.

PARASITIC INSECTS

The *Pediculus capitis*, or common louse, infests persons who are unclean in their habits, particularly children. Their eggs are commonly known under the name of nits. To eradicate them the hair should be cut short, and the head and other hairy parts of the body should be rubbed with a lotion composed of 3 oz. of cologne with $\frac{1}{2}$ gr. of corrosive sublimate, or carbolic acid may be used, in the proportion of 1 dram to the pint of lime-water liniment, with the addition of $\frac{1}{2}$ dram of oil of cinnamon.

Pulex irritans, or the common flea, is a universal pest in Asiatic countries, and, as we have remarked, is the great agency for the dissemination of the pestis or plague. I was once obliged, on account of a great rain, to pass the night in a peasant's house in Mount Lebanon, where I could not sleep a wink all night from the bites of fleas. The next morning I was simply covered with the consequent eruption, which caused a slight fever. In that country a powder, made from some vegetable substance, is sprinkled in the bed, which is probably the *Actæa spicata* or baneberry. The next morning the fleas are found benumbed by it, so that they can be readily collected and destroyed.

Some species of flies also become very troublesome by their invasions. The ova of the blue-bottle fly may be deposited in the nostrils, the ears, or the conjunctiva. This invasion rarely takes place unless the mucous membrane of these regions is the seat of disease.

Liquids should not be injected into the nose, owing to the danger of infecting the Eustachian tubes which open into the pharynx on a level with the floor of the posterior nares. I have seen a case of total deafness caused by a neglect of this precaution. In our article on

Chronic Coryza we have spoken of a powder being blown into the nose by an insufflator which contains 8 gr. of aristol, 12 gr. of salol, and 4 drams of subcarbonate of bismuth. A quantity, such as would cover a ten-cent piece, may then be put in the scoop of the insufflator and blown as a fine smoke into all parts of the nose, the mouth meantime being kept wide open.

The larvæ of different species of flies may either be swallowed, and produce disorders of the intestines, or infect the skin, with the result of various cutaneous manifestations. Such cases are reported from every country in the world, from Russia to South America, and should be treated by local applications, varying according to the nature of the case.

AFFECTIONS FROM CATERPILLARS

In this country the brown-tail moth when it abounds in any locality, particularly in New England, sheds its barbed hairs, which then come in contact with the skin, producing severe itching and eruption, even being mistaken for small-pox. Similar affections are reported from Europe, especially in England, from the yellow-tailed moth, and from the procession caterpillar in Switzerland, where its prevalence makes some districts uninhabitable.

CHAPTER XIV

DRUG HABITS

ONE of the most unwelcome dangers which may occur to a physician when he prescribes a medicine as a remedy is that the patient may become addicted to it and form a wholly ruinous drug habit. He should, therefore, clearly understand what it is in each medicine which leads to the formation of such a habit; only thus will he perceive where his responsibility begins and where it ends in ordering a person to have recourse to the drug.

Opium.—We begin, therefore, with the most insidious and most disastrous of drugs when the unfortunate person has become enslaved by it, and that is opium. Few persons understand what it is in opium, well designated by the ancients as the great gift of God for alleviating suffering, which may in time become an irremovable curse. Its dangers all lie in its seductive attractiveness.

Thus, a man may arrive at the stage when he takes laudanum not as a medicine, but as a drink; that done, soon a sense of intense interest is awakened in him similar to that of an amateur fisherman when he gets a strong bite. All fishermen know that every concern in life is displaced for the time by that pull on their line. At first he scarcely knows what his laudanum-born interest is about. But soon a crowd of thoughts arrive, bringing with them the pleasing assurance that to produce such a succession of splendid ideas this thinker, at any rate, owns a first-class brain. Up he ascends, as if to take a seat on a cloud, where he can serenely look down on this poor mundane sphere, feeling himself quite above its fussy littleness. Such conditions are graphically described by De Quincy, in his "Confessions of an English Opium Eater," and we refer the reader to that classic book.

As might be inferred, the man is all the while centered on the creations of his own imagination, and, therefore, the opium eater is solitary and dislikes interruption by others; but, after the effect has passed off, it is succeeded by a sense of horrible vacancy, sometimes referred to the pit of the stomach, which causes a restlessness that nothing will relieve but more opium. So naturally, but so characteristically, is his subsequent course that in time he becomes styled an opium fiend,

from long living in an unreal world, and becomes transformed into the most all-round liar in the land, the very embodiment of unveracity. One of them victimized me with a loan that he might go and close the eyes of his dying mother, when her eyes needed no such closing for years afterward. Another sent from a Western city to his wife a telegram, which purported to come from an undertaker demanding money to pay for shipping his body home; this money when it came he—and unfortunately no undertaker—pocketed and then went his way. I have had such fellows tell me, with tears in their eyes, that their chains had been broken the night before in answer to their earnest prayers, when I could see that they had taken a dose that same hour. And so their deterioration progresses until all sense of honor is gone and they sink below that last refuge of self-respect—shame.

Alcohol.—The next specimen is a man who, if he is in a prohibition town, goes to a drug store and, with a knowing wink, asks for “*spiritus frumenti*,” vulgarly known as whisky. It first makes him smile, and soon he shows that not so much his thoughts as his emotions are excited. As it is not natural for a man to keep his feelings to himself, but rather to share them with others, the alcohol taker contrasts with the opium taker in being very sociable. The usually reserved man admits people into his confidence and talks familiarly with everybody present. When a number are sharing their drinks and feelings together with laugh and song, the swift flow of emotions may unhappily strike some rock, which so violently deflects the stream that heads collide and the scene ends in a general row. Other developments are too familiar to detain us, as our present object is rather to note the characteristic workings of alcohol on the mind. We all know what the confirmed drunkard becomes, but not till the judgment day will the whole story be known of the griefs and tears of the innocent ones whom the drunkard made to suffer while he was here.

One of the drugs which is most striking in its effects is **hashish**, or *Cannabis indica*, largely taken in Asiatic countries, where I used myself to meet its votaries. Its chief peculiarity is to make one believe with all his might whatever is suggested to him. If he is an Arab, tell him that he is a sultan, and straightway he becomes chesty, to use Devery's term, and royally orders heads to be cut off. Tell him he is a rooster, and he will crow. I knew of two Americans who experimented on themselves, and when the first was told that he was like a locomotive, he snorted and whistled, and kept going round the table puffing and blowing until he dropped from sheer fatigue. The other

somehow conceived the idea that he was dead, and forthwith gave elaborate directions for his own funeral, till he waxed wroth at the unseemly mirth of his companions when they should have wept. Whoever wishes further details about the weird play of this drug on the mind may consult Hugh Ludlow's book on the hashish smoker, for he writes as if he still kept up the habit.

We will now mention what may be truly termed the "artistic poison." This is the **mescal button**, which grows on a low cactus in the valley of the Rio Grande, and, fortunately, is scarce and hard to get. Chewing this button causes the most gorgeously colored scenes to appear before the entranced vision, far surpassing, according to descriptions, the most magnificent sunsets. It would seem to be the drug for landscape painters, but, unfortunately, whatever other things drugs do, they never increase efficiency. It was first discovered among the Kiowa tribe of Indians, who used it in their religious rites, until missionaries induced the United States Government to remove the Indians from where they could get it. The following account, given by a scientific experimenter with it, will give an idea of the extraordinary properties of this drug:

"When I chewed the fourth button there followed a train of delightful visions such as no human being ever enjoyed under normal conditions. An ever-changing panorama of beauty and grandeur, with infinite variety of color and form, hurried before me. I thought that I had experienced great pleasure on many former occasions, but the experience of that night was quite unique in the story of a lifetime. The colors of the objects were wonderful, like colors of the spectrum, intensified as though in the fiercest sunlight, while some of the pictures were like tapestry designs, others of human beings in dances, processions, etc., and others were lovely scenes in nature."

We conclude with one of the most damaging of all these drug poisons, and that is **cocain**, which is derived from the cola leaf of a plant which grows in Peru and Bolivia. Chewing of these leaves causes a person at first to have an exhilarating feeling of general muscular power, rendering him seemingly incapable of either fatigue or of hunger. There is no doubt that under its influence an unusual amount of fatiguing exercise may be taken without being felt, and it is this which causes the cocain habit to be contracted, with ultimately the most complete demoralization of the individual.

While cocain is thus consumed in all parts of the world, the British Government in India has been obliged to prevent its sale there except under the most stringent regulations. Persons who have already

become victims to the opium habit are peculiarly liable to contract the cocain habit also.

But how about all this and ourselves? We seem to feel and to think, and, therefore, to be, according to what we swallow. One can readily admit that his physical frame is made from foodstuffs, but here we note that if we take enough laudanum we think and feel and act as opium takers do, and every one knows how different a whisky sot is from a teetotaler. Our brains, therefore, appear to be like those music-boxes which turn out different tunes according to what disk is put into them. If this be not so, then why can drugs so specially modify our whole mental and spiritual being?

According to some, these actual facts and many others of a similar kind prove that, after all, we are but material mechanisms which work solely according to their makeup. The logical conclusion from this statement is that man is altogether a thing, and a desirable or an undesirable thing, just as he happens to be constructed. If he is made badly, as by birth from a poor stock, he will and, indeed, must be bad, while if he is well made he will stay good. It all depends on the material conditions of his material brain.

No sensible person believes this, and yet this doctrine seems to fit in with so many facts that some clear demonstration of its fallacy is much needed. It is the physician who now should be asked what he has to say on the subject, because naturally he is the one best qualified to know whatever is known about both drugs and brain. Moreover, lately he has made great discoveries about the relations of the brain to the mind by observations which he alone could make; of the effects of local injuries to brain matter caused by disease or by accident.

But how different the facts about these two subjects are from what most people imagine, he shows by saying that drugs no more affect the brain than insanity itself does—that is, not at all! In support of this statement about insanity he can refer to the most complete description of the microscopic structure of the brain lately published, which is by Dr. A. W. Campbell (Cambridge University Press, 1906), and is based on laborious investigations of 8 normal human brain hemispheres compared with the brains of 2 chimpanzees and 1 orang. But of the 8 human hemispheres, 6 were those of lunatics who died insane, Dr. Campbell merely remarking of them “that he was convinced from a lengthy experience in the pathologic laboratory attached to the Rainhill Asylum that in such lunatics all the microscopic methods at our disposal will fail to disclose changes, either in the nerve-cells or fibers, which we can refer to their altered mental condition.” In other

words, that insanity neither affects nor deranges the brain structurally.

As to the drugs which we have mentioned, he denies that any of them injure the brain except alcohol, which does injure the brain, though not at all on account of its mental effects, but for the very different reason that alcohol has a chemical affinity for the albumin and fats of the tissues. By this chemical action it slowly alters and damages brain tissues, but this result in nowise differs from similar alterations produced by alcohol in the tissues of the liver and of the kidneys. Tissue changes in the brain will, of course, derange its working, as is illustrated also by the destruction of the mind accompanying that ruin of brain matter caused by the slow action of the virus of syphilis when it causes paresis, or the so-called general paralysis of the insane. Those drugs whose mental effects we have described never leave a trace of their action on the brain, nor do any other similar agents.

Further, he has discovered that in what may be called the human half, in distinction from the animal hemisphere, are the actual material places where, and only where, the great and exclusively human mental faculties reside. Elsewhere in the head they are not found. The anatomist had noted before that our brain matter is collected in two symmetric hemispheres, which are as perfect pairs as our two eyes and our two ears, while the physiologist is certain that originally both hemispheres are equally good for acquiring mental endowments. But neither anatomist nor physiologist can see the brain thinking. None but the physician, by his above-mentioned observations, would have discovered that even a special mental operation must have its own little special locality among the many other mind-endowed places in the human hemisphere.

Thus, Ralph Waldo Emerson lived for some time no longer Emerson in word or thought. He began by losing not only his verbs, but all his nouns, because the place for nouns in his left brain was spoiled. He had the same place all right in his other hemisphere, but it was then too stiff with age to take the impress of a single noun. But, likewise, all the chief mental faculties may go together if the damage is extensive enough in the thinking half. One of the strongest thinkers and best trained writers in my acquaintance was suddenly so totally wrecked mentally that he was not only speechless, but could not recognize any one of his family, and he remained so for months, though until his death his right hemisphere was as sound as ever.

In my book "Brain and Personality" I have explained why it is that the left hemisphere in right-handed persons and the right hemi-

sphere in the left-handed is the human brain. Briefly, the two brain hemispheres in our head are analogous to two phonographs, because phonographs can no more themselves cover their wax leaves with words expressing ideas than they can make wax think. The phonographs are wonderful instruments, but they are never anything but instruments; and so the brain hemispheres are the instruments of the thinker, and nothing more, for if they could themselves think, then both hemispheres would think as a matter of course, when, as a matter of fact, only one of them has a single imprint of the human mind in it.

What is it, therefore, that thinks? Unquestionably, it is the human personality, which is itself independent of the brain that it uses. So far as the brain is concerned, it is simply physical in its structure and chemical in its composition. But here, in one of its halves, we are face to face with the tremendous exception to everything earthly. The evolutionist can make a good showing that in structure man's brain differs but little from the chimpanzee's, just as it should in the ascending series of animals, but when it comes to the human mind the evolutionist has to quit. What but a mind worked by a man could both weigh and accurately locate in the heavens a great planet which neither he nor any one else has yet seen? And so the human world abounds with innumerable utter impossibilities for mere animals to achieve.

Mentally, therefore, man is as much out of keeping with the entire succession and developments of evolution as any being from another world would be, and those who still would say that because the human brain so closely resembles that of the ape those two cannot be far apart, are themselves their only good arguments. Meanwhile, for this human thinker one instrument for thinking is enough, and he does not need two hemispheres any more than a violinist needs two violins. The second hemisphere is then only to provide against accidental damage to the first, when, if he be yet young, the thinker can in time teach it to become human also in mental powers, but not if its cords have become too stiffened with age.

The bearing of these facts on the subject of the action of drugs on the mind is this, that if the brain is as much the instrument of the thinker as his hand is the mechanic's, then the work which it can do will depend on the physical conditions of the instrument itself. A watch-maker may be as skilful as ever at his trade, but he can hardly mend a watch with gloves on, still less if he puts his hands in mittens. But that is just what the thinker does with his instrument for thinking when he gets drunk. Alcohol in one amount will hamper the working of his brain instrument as much as gloves would the fingers of the watch-

maker, and in increased quantity will make it wholly unworkable. Instruments are never more than instruments, however they work. The eye is the instrument for seeing, and man has invented an opera-glass to make it see better. If one of this instrument's lenses is made of blue or green or yellow glass, everything seen through it will appear blue or green or yellow accordingly; but is it the opera-glass or the person using it that sees?

But if we are not our brains, nor our brains the same with us, then what are we? The wise injunction of the old Greek sage, "know thyself," is as binding now as ever, for the self in us is the hardest of all things to know, and, therefore, what facts modern medical science is able to add to that knowledge should not be neglected. Our subject of mind and drugs is now seen to be a test almost like a laboratory test of what the self in us is, with the result, unexpected to many, that as we are not our brains, neither are our minds wholly the same with ourselves. The real self in us is as far superior to the mind as mind is superior to the brain. We shall see that the mind has little reason to dread the drug, but the self indeed has, and should regard the drug as a most dangerous enemy.

When we consider what the faculties of the mind are, such as memory, imagination, perception, and, above all, understanding or reason, it would seem that we could not ask for anything more to complete our individuality. But the truth is, that a man's mind is not himself, but his, and because it is his it is perfectly detachable from his true self, so that he can hire it out, as he would a wagon which he owns. This is just what lawyers do for their living. To his client the lawyer hires out his whole mental equipment of learning, power of expression, of persuasion, and of reasoning, and, if desirable, he will throw his emotions into the bargain. A noted criminal lawyer in New York had a valuable asset in his tears, which he had so well on tap that when he saw that the psychologic moment had arrived scarce a jury could stand the gush. But was he himself in evidence then, or only his lacrimal apparatus? Without his fee there would not have been a tear. But lawyers are no different from other people in this respect. Every one's mind is entirely distinct and separable from himself.

The highest element in us is the will. We are thus brought finally to that centric element in us which, as we have said, outranks the mind as truly as the mind outranks the body. We are altogether what it is, whether we be strong or weak, good or bad, for as it slowly molds brain, so it slowly but permanently molds that most personal of things—character. It is the conscious purpose alone in us which does anything, and

what can a strong purpose not do, especially with brain matter? How this fact alters all standards of estimation! Excellence of body is good, but that does not lessen the number of handsome fools or of silly beauties. Fine mental gifts are great gifts, but that does not prevent many of their possessors from being failures in life's upward way, because they had no staying power for the climb. A man with a strong will can make his human hemisphere abound with great educated centers, because he can take the time and the trouble to make them. The bright but weak-willed man does little after he is fifty but sigh over past indolence or, more commonly, whine at his bad luck.

But we must now come back to our original subject—drugs—though in such a connection as to make the mere mention of them repulsive. On the one side is a splendid being, with a majestic endowment, whereby he can rule and direct both body and mind, and himself make a brain matchless for its powers. On the other is a human wreck, wholly thus from addiction to a drug. Did that baleful agent injure his body? Not much, for I have known a victim of opium to outlive both near relatives and friends of former years. Nor do such things perceptibly injure the mind, for many of these poor creatures can yet talk beautifully and write elegantly. But in them the will can no longer rule! That is why the man is ruined. The drug has completely dethroned the will, and when the will falls everything good in the man comes down with it. In short, the whole ruinous power of such drug habits is that they dethrone the will from its rightful sway over everything in us. How it does this is an impenetrable mystery. Practically the only sure way for the victim to recover from the evil sway of his drug is to get away from it; by his bodily removal from where he can get it. This measure may be difficult to attain, but still remains the only certain cure.

CHAPTER XV

MINERAL POISONS

WHOLLY different from the drug poisons which we have just been discussing are those common poisons which are of a metallic nature, namely, arsenic and lead. When we are sure, owing to their characteristic symptoms, of their presence in the body, it may not be easy in some cases to discover how they entered it. Thus, I was called in consultation by a physician to see a woman dying from symptoms of profound anemia without emaciation or fever. She told me that her husband had died with just the same symptoms a year before. On examination I soon became convinced that nothing but chronic arsenic-poisoning would account for her condition. I first asked if she had been sleeping in a room with green-colored wall paper, because certain arsenic dyes, which never fade, were once used by manufacturers of wall papers until they were forbidden to do so by law. Similarly, no articles of furniture with green baize covering were to be found, but I found that she and her husband owned the fine house in which they lived, and whose apartments they rented, leaving for themselves only the basement, in which they dwelt and slept. From the large front room of this basement they derived a further revenue, which itself was the cause of their deaths, by letting it out for the reception of deer and musk-oxen and elks heads consigned to their keeping by their owners in the summer months. Now these animal heads can be preserved from attacks by insects or by molds by being charged with arsenic, and these persons were accustomed frequently to go into this room to brush the dust off these objects. I accordingly directed that the woman's urine should be examined for the presence of arsenic, and this was found in abundance at the laboratory.

LEAD-POISONING

The origin of poisoning by lead may often be just as difficult to demonstrate. I had a gentleman who had been a patient of mine for years, who came to me for a localized pain just above the pubis. He had been sounded several times by eminent surgeons for stone in his bladder without finding any. At last, when he said the pain was intolerable, I concluded to try the faradic current through the rectus muscle,

to see if that would relieve his pain; on doing so I discovered that this muscle would not respond to the electric current; this at once suggesting to me that it all was due to lead-poisoning. As no other members of his family had such symptoms, I asked if he was accustomed to drink the water from the faucet early in the morning before any one else, and failing that, whether he frequented soda water fountains at such times; as he denied both these questions, I then asked him whether he used any hair dye on his thinly covered scalp; he admitted that he had for fourteen years. On asking for a specimen of this hair dye, I found it to be a pure sulphite of lead, which sufficiently accounted for his trouble. Not long afterward he walked the street, a white-haired man, but with no pain over his pubis.

Symptoms.—We begin with the symptoms of lead-poisoning; which are so common that it is doubtful whether, in the conditions of our modern life, many persons escape having some lead deposited in their tissues, but when minute in quantity this will occasion no perceptible derangements. In my experience the commonest symptoms to excite suspicion are recurrent neuralgic pains throughout the limbs, and especially in the arms. I have often noticed these to occur in farmers' wives, in whom I had my suspicions first aroused by finding that they had a high-tension pulse, with sometimes tophi in their external ears, thus showing their tendency to gouty disorders. Now lead-poisoning has long been known for its likelihood to engender gout, and, on further inquiry, I found these women drank water supplied through lead pipes brought from a distant spring.

The more pronounced symptoms of lead-poisoning, however, occur in those whose occupation causes them to be in constant contact with lead. Thus, it may occur in printers, who, while setting up type, often hold the type in their mouths. It is, however, painters who suffer the most. As we have remarked before, the skin does not absorb water unless in the form of watery vapor or steam, but painters using white lead are much more quickly poisoned when they add turpentine, which is volatile, in mixing their paints. On that account I have found coach and carriage painters, who use various varnishes in their work, therefore particularly susceptible. Those engaged in the smelting of lead ores are often attacked, owing to the lead being vaporized by heat. Wines and cider which contain acids quickly become contaminated in contact with lead. The susceptibility to lead-poisoning is also greater in women than in men, some putting it as high as 4 to 1.

It is probable that the commonest mode of entrance is by the alimentary canal, but other avenues are also opened, particularly the

lungs, which inhale as a vapor, and the skin, by direct contact. Lead has a particular affinity for certain muscles. Thus it affects the extensors of the forearm and wrist, and also the rectus abdominis muscle; such muscles are found to be degenerated and look yellow, fatty, and fibroid, while the nerves show a special degenerative neuritis.

The symptoms of lead-poisoning may be either acute or chronic. Thus, there may be a rapidly developing anemia accompanied by severe nervous symptoms, such as convulsions and delirium not unlike those of acute alcoholism. Some cases which are soon fatal are accompanied by severe gastro-intestinal symptoms.

Changes in the blood are common, but not limited to lead-poisoning, except that such changes are so much more pronounced after lead that they may be of diagnostic importance. These changes consist in a granular basophilic degeneration. One of the most significant findings is the presence of nucleated red corpuscles.

By far the most distinctive sign is the blue line at the junction of the gums with the teeth, due to the precipitation of sulphite of lead, caused by combination with the tartar of the teeth. This should always be looked for, but as it may be removed by the daily use of the tooth-brush it does not occur commonly in mechanics exposed to lead.

The most common symptom, however, is the well-known lead-colic, which is found preceded by obstinate constipation; the pain may be diffused, but is most pronounced about the umbilicus, when it may be suspected by the gesture of the patient describing it. He forcibly grasps the part and moves his hand as if it were like the pain of an augur being driven into that part; this at once shows that it is not an inflammatory pain; moreover, it does not extend to the back, as in the hepatic colic, nor down the groins, as in renal colic. In other words, lead-colic has all the characteristics of a true colic, coming on like other such affections in paroxysms, which may be succeeded by a general soreness in the parts.

Lead-palsy is so peculiar in its symptoms that it may be itself diagnostic, appearing almost exclusively in the forearm and affecting the extensors, so as to cause that characteristic wrist-drop sometimes seen only in the arm which is most used, namely, the right, but usually in both, besides paralysis of the extensors of the wrist. The extensors of the fingers may also be affected.

Rarely we have the brachial type, which involves the deltoid, and the brachial anticus, so that the arm cannot be raised.

A very frequent form of which workmen bitterly complain is when the interossei muscles are attacked and wasted, so that the hand is incapacitated for performing any fine work.

While the upper limbs are attacked in about 85 per cent. of all cases, the lower limbs may be affected in from 12 to 15 per cent., though in my experience the percentage is much less, but doubtless is higher among those observers who have more extensive opportunities among workmen in factories. When the lower limbs are attacked it is usually the peroneal muscles; the extensors of the toes, including the big toe, are affected, producing the "steppage" gait.

In the larynx adductor paralysis has been noted by certain laryngologists.

Rare instances are referred to in medical literature of a general paralysis of all muscles below the neck, accompanied with wasting, and due to lead-poisoning, this diagnosis being further confirmed by recovery after special treatment.

Lead-poisoning may be fatal in those acute cases in which the brain itself is affected. These patients may have true epileptic convulsions, followed in some cases by delirium, and in others by coma, following either convulsions or delirium.

Treatment.—In all cases of lead-poisoning of whatever form or degree the first indication is to get rid of the lead. We can depend upon the kidneys for doing that quite promptly if we administer iodid of potassium in 5- to 10-gr. doses, which combines with the lead wherever it is found, as iodid of lead is quickly eliminated in the urine. In obscure cases this may be used for diagnosis by the appearance of iodid of lead in the urine.

The treatment, however, of the wasted muscles takes much more time, but for this we fortunately possess a very effective agent in the far-adic current of electricity. This is particularly illustrative in the restoration of the small wasted interossei, to which we have already referred, because this current is always limited in direction to the shortest distance between its two poles. Two electrodes tipped with sponges may then be applied, one at each end of the affected muscle, and the current continued for fifteen minutes. This done four times a day, the muscle, in about a week, will be found to have recovered its bulk and equally so its function. In longer muscles, as in those of the shoulder and upper arm, or in the case of the rectus abdominis, the same good results of this current are obtained.

An occasional morning purge of magnesium sulphate may be prescribed.

ARSENIC-POISONING

Acute poisoning by arsenic rarely occurs except when it is taken with suicidal intent, and we would refer the reader to treatises on toxicology for both the symptoms and treatment of such patients. We have already referred in this chapter to chronic arsenic-poisoning, the sources of which may be very numerous, as mentioned in the case there detailed. It is otherwise when arsenic has been administered as a medicine, as in the treatment of chorea, which I have condemned. Arsenic is also often employed as a remedy in chronic disorders of the blood, as in pernicious anemia, but its most common and prolonged use is in the treatment of psoriasis, where it is often quite beneficial. Psoriasis, however, is best managed by omitting everything like the red meats in the dietary, but, however used, the physician should be on the watch for the first symptoms of arsenic-poisoning. These are a sense of weight or uneasiness, with tenderness on pressure at the epigastrium. Conjoined with this is a puffiness of the eyelids, and after a time numbness and tingling in the fingers, and sometimes with the same symptoms in the toes. When these symptoms first develop the arsenic should be abandoned, or only resumed after the system has had time to get rid of it. Arsenic-poisoning has also occurred in women who have taken the drug for the improvement of their looks, on the mistaken supposition that it causes a better complexion.

We have some curious illustrations of the tolerance by the stomach or general system of such corrosive poisons as arsenic or corrosive sublimate which are difficult to explain. Thus, the peasants in the district of Styria, Austria, may take as much as 8 gr. of arsenous acid a day, and a Turkish soldier once in my presence took from 8 to 10 gr. of corrosive sublimate, which he licked off the palm of his hand, to the great alarm of the native Christian apothecary who sold it to him. I personally watched this soldier for an hour after he had taken such a quantity of this poison, but he only laughed at me, and said that he took this drug, like other people in his country, for improving his sexual power.

Prolonged administration of arsenic, however, may produce a characteristic pigmentation of the skin and occasionally ulceration of the cornea.

CHAPTER XVI

DISEASES OF THE NERVOUS SYSTEM

GENERAL INTRODUCTION

AUTHORS have very properly divided nervous diseases into functional and organic. This cannot be done in the case of any other tissue or organ of the body. Thus, no disorders of the lungs, liver, or kidneys are called functional, because their causes are generally to be found in structural changes in them, but the most diligent search in nervous structures may altogether fail to discover the organic change to which melancholia or epilepsy are due. The important conclusion from this fact is, that we should look elsewhere than in nervous structures for the true origin of what are well-termed functional nervous disorders.

Organic nervous derangements may be divided into the accidental and the primary classes. In the accidental class the cause is not in the nervous mechanism. Thus, the entrance of a bullet into the cranium may cause all the symptoms of an ordinary hemiplegia. But no one would think of blaming the brain for this damage. Yet an apoplectic clot is usually just as much the physical origin of a hemiplegia as any other physical agent. But in this case it may be a purely arterial and not a cerebral disorder which causes the accident to the brain.

Primary organic nervous diseases, on the other hand, are recognizable by demonstrable and characteristic changes in nervous tissues themselves. Thus, in tabes the posterior columns of the spinal cord are found shrunken and wasted, because their constituent neurons are so evidently by the action of a specific toxin. How far other organic nervous degenerations are similarly caused by toxins is not yet known, and is an important subject of research.

The term "neuron" should here be defined. We no longer think of the nervous system being composed of a collection of specific cells, like the specific cells which make up the substance of liver or kidney, but of a collection of an immense number of units, composed of a cell with its dynamic center in the nucleus and the cell body, which is itself traversed by innumerable nerve-fibrils, many of which come to it from without, and are called dendrites, while others are collected into

what is called the axon, which leads away from the cell body. The axon may be very long, reaching from a cell in the brain cortex to the termination of the pyramidal tract in the spinal cord. In its course the axon gives off a succession of its fibers at right angles, and finally ends in a brush-like termination in a muscle or gland. But the point is, that the fibrils of a neuron do not actually anastomose with the fibrils of other neurons, because simple contact with them is enough for the functions. In this sense, a neuron is an independent entity. Neurons, when they have the same functions, are usually collected into bundles. These bundles are often contained in sheaths, and thus acquire the name of nerves, as the facial, ulnar, or other nerves.

The independence of neurons is often illustrated both in health and in disease. Thus, the brain cannot of itself get a single muscle to act. It must ask the neurons of the spinal cord to do that, for without the spinal cord no voluntary muscle will do anything, not even a little wink. In diseases, as in tetanus, the spinal cord may tear the body by violent muscular contractions till death follows, the brain meanwhile being helpless to prevent it, so whole classes of nervous diseases are due to the morbid independence of the spinal neurons.

We now should mention the important place which is held in all nervous functions by what is technically called inhibition. To inhibit means to check, and from the simplest response of a spinal nerve-center to a stimulus, up to the most complex mental process in the brain cortex, we meet with what are virtually mutual checking operations. Thus, when flexor muscles are made to contract, the corresponding extensor muscles should simultaneously relax, not passively, but actively, for it is now known that muscular relaxation needs its proper stimulus to relax, as otherwise the muscle will spontaneously pass into the contraction of rigor mortis.

One of the most striking examples of inhibition is found in the normal actions of the heart. This organ is supplied by a set of nerves coming from the spinal cord, called the accelerators, because their stimulation causes the heart to beat faster. But it is also supplied with inhibitory fibers coming through the vagus, which make the heart beat slower. Cut these inhibiting nerves, and the heart bounds off like a runaway horse which has thrown its rider. So powerful is the action of the inhibitory vagus nerves that they may cause death by bringing the heart to a permanent stop, as in some cases of mental shock.

But inhibition meets us at every turn in studying the operations of the nervous system. In the spinal cord we find a succession of ner-

vous centers, one above the other, each lower set being regulated by inhibition of the centers above it, until we reach the brain, which by rights should regulate the whole. In short, a normal human nervous system is like a great well-disciplined army, with every kind of rank in its officers, from the lowest to the highest; and many serious nervous diseases are due to the loss of inhibitory discipline.

Embryologically, the spinal cord is the original nervous system, the ganglia of the special senses being afterward developed upon it, the nuclei of which remain in the medulla. As we have before remarked, the movements of every muscle of the body are primarily caused by impulses proceeding from the spinal centers. With the further development of the brain itself the neurons of the nervous system are divided into two great segments, the upper one on the motor side consisting of the fibers that compose the pyramidal tract, which, beginning at the cortex of the brain, then converge to a compact bundle, passing through the internal capsule, then through the pons and crura cerebri, and so on to the floor of the fourth ventricle in the medulla, where they form a pyramidal bundle, from which the whole tract gets its name. At the lower end of the medulla the fibers of the pyramidal tract decussate, so that the motor impulses of the left hemisphere correspondingly govern the right side of the body. The pyramidal tract from this on is constantly giving off its fibers, until it ends about the middorsal region of the spinal cord. Meantime these neurons from the corticopyramidal tract do not connect directly with the cells or processes of the spinal motor centers, but end in a network of fibers around the spinal motor cells, in the anterior horn of the gray matter of the spinal cord. In this way the upper segment of the motor tracts coming from the cortex are constituted. The lower segment begins with the cells in the anterior horn of the spinal gray matter, whose fibers continue on till they end in what are called muscle plates in the voluntary muscles, while others end in the cells of a secretory gland.

Thus, every voluntary muscle of the body is directly governed by the neurons of the lower segment. The brain, therefore, cannot directly act upon any muscle, as we have remarked, but only through the mediation of the motor cells of the spinal cord.

All motor operations of the spinal cord proceed from within outward, and hence are called efferent. All sensory operations, on the other hand, proceed from the outside inward, and hence are called afferent. But, whereas the efferent or motor impulses are relatively simple, the afferent stimuli come from the whole outer world, and,

therefore, are so varied that their tracts inward and upward in the spinal cord become very complex, corresponding to transmissions of the muscle sense, of the sense of touch, of heat and cold, and of pain, with their several varieties.

Besides, there is an anatomic difference, consisting of a spinal ganglion found on each sensory root before it enters the cord. This ganglion on the posterior root of each sensory spinal nerve is composed of peculiar, bipolar cells; whose processes, at first single, soon divide like the letter "T." One branch enters the spinal cord via the posterior root, the other to constitute a sensory nerve-fiber to be distributed to some sensory surface. The striking characteristics of this cell are that it gives rise to two nerve-fibers, and that it possesses no dendritic processes. Exactly similar cells are found in the ganglia attached to the sensory fibers of the cranial nerves, like the Gasserian ganglion of the fifth, and on the other cranial nerves with sensory branches, from the fifth cranial to the seventh, the eighth, the ninth, and the tenth cranial nerves. It is worth noting that the ganglion on the sensory spinal nerves, like all of them, arises from cells lying on the outside of the main axis of the central nervous system.

FUNCTIONAL NERVOUS DISEASES

EPILEPSY

Nowhere, as in nervous disease, is the fundamental difference between functional and organic derangements in brain matter so clearly illustrated. Those due to demonstrable organic changes always show corresponding clinical symptoms. Thus, no hemiplegic patient, who has had a gross lesion in one brain hemisphere, ever walks again as if nothing were the matter with him, nor does a man with tabes fail to show it in his gait.

Not so with that functional disease, epilepsy. The most practised neurologist cannot distinguish beforehand an epileptic in a company where he may be talking as usual, until suddenly he falls in a violent convulsion. Before his fit he may have gone for weeks or months without a sign in mind or body of his serious disease.

Complete intermission is a feature of functional diseases of far-reaching significance, because it shows that the original seat of the malady is different from that of any affection due to a structural derangement. Structural derangements in the body remain always the same and so do their effects. Therefore, we must look elsewhere than in the nervous mechanism for the primary cause of epilepsy.

As every attack begins with a disturbance in some region of the brain cortex, many writers maintain that an organic change of some kind must be present in that particular region. Thus, malformations of the brain itself are often accompanied with epilepsy, and various stigmata of an epileptic constitution are described. But more conclusive still is the well-known fact that healthy persons, who have no hereditary tendencies to the disease, become epileptic at various intervals, after some injury to the skull, or even following the surgical operation of trephining. In other cases the remains of a venous clot, occurring in the brain during an infection like diphtheria, may afterward be the origin of epilepsy. These writers, therefore, claim that epilepsy is always due to some such organic change, whether this be discoverable or not.

But this view overlooks the difference between primary and exciting causes. A primary cause remains ever the same, but exciting causes vary indefinitely. I had an epileptic who for years suffered from fits till her mind was affected, but who had not had one attack for five years after an operation upon her nose which I advised. This nasal trouble in her, of course, was nothing but an exciting cause, and so I would classify all cases in which some intercranial organic lesion appears to originate the attack. Those lesions stand to the disease in the relation of exciting causes and nothing more. The primary cause, without which the exciting causes would not operate, may be outside the skull, and should be dealt with first.

On this account the demonstration of the essential cause of such a functional disease as epilepsy may be one of the most difficult problems in pathology. Organic changes are easily detected, but a disease which may not necessarily be connected with a demonstrable organic change is far more difficult to demonstrate, and we have to decide, first of all, what its essential characters are. Now, as these fundamental characters of epilepsy become understood, the more the conviction grows that it stands alone among nervous diseases, and does not share its chief factors with any of them. The main question, therefore, is, What constitutes epilepsy? What is the constant fact in epilepsy, the presence of which at any time, though it be quite single or slight in its manifestation, proves it to be epilepsy, even if unaccompanied by other symptoms ordinarily present?

This question about what thing is invariable is all important in the consideration of obscure problems in medicine, because of the general principle that whatever is occasional is not essential. No matter how often or how prominently any given symptom or set of symptoms may

occur in the course of a disease, those symptoms cannot be essentially related to its primary cause if undoubted examples of the disease occur without them. This one fact, that the disease can exist without them, at once reduces such occasional symptoms from the rank of a causative to that of merely an accessory relationship to the disease. In other words, symptoms may vary, but real causes do not.

Tested by this principle, epilepsy cannot be defined as a convulsive disease. Convulsions very commonly occur in epilepsy, but by no means always, and this alone proves that convulsions are only occasional effects and not inherent elements in epilepsy. As epileptic convulsions are such pronounced and terrifying manifestations of the malady, it was inferred that those who had them were more complete examples of the disease than those who did not have convulsions. The old terms "grand mal" and "petit mal" illustrate this misconception, attacks of petit mal being often spoken of as mild attacks. I doubt if there ever is a mild attack of epilepsy, however brief in duration or seemingly trivial it be in appearance. Let a patient under treatment, who seems to be about cured, because he has passed months without his old convulsions, make a statement that he just lost consciousness for a moment that morning, but that it did not amount to anything, and he discourages the physician. His patient is still an epileptic, and there never is an incomplete epileptic. No matter how mild the attacks seem, they are wholly unlike mild forms of any other nervous disease, and with the same tendency to ultimate grave results as in the most pronounced convulsive forms.

One further undesirable effect of undue estimation of the convulsive element in epilepsy is its suggestion that the first process in an attack is of the nature of a sudden liberation of energy in some part of the brain. Many writers speak of epilepsy as beginning with a discharge of nervous force in a cortical area or center, the conception evidently being something like the electric discharge of a Leyden jar. But this conception is derived only from the starting motor phenomena of a convulsive paroxysm. If attention were equally directed to the symptoms of true epileptic attacks, which are not at all convulsive, this idea of explosion would be as little suggested as in a case of syncope.

Again, it would not be correct to define epilepsy as a cerebral disorder, producing loss of consciousness, because loss of consciousness, or even interference with consciousness, is not invariable. I have published the case of a patient, brought to me by Dr. Alexander Strong, of New York, who would begin with the fearful epilepsy cry, then biting

of his tongue, followed by violent general convulsions. He had two such convulsions in my office that were completely typical of the disease, but I found afterward, by testing him, that he never lost consciousness of what I was doing before him. Hence, loss of consciousness, because not invariable, is not essentially related to epilepsy, and gives no clue whatever to the nature of the disease. In fact, loss of consciousness *per se* is the least helpful of all symptoms toward affording an insight into any brain process, as the problem of common sleep testifies.

If epilepsy were a disease like hysteria, of every grade of severity, if not also of diverse nature and kind, in different patients, we might grade the symptoms of epilepsy into mild or unimportant and into severe or grave symptoms, regarding epilepsy as a trivial disease in some patients and a grave disease in others, according to the nature of their symptoms, but such is never the case. A child three years old, for example, was brought to me for what his parents called "a caper" of his—suddenly ducking his head now and then; soon they smilingly told me to look for myself, and see how he did it. I at once saw that in this "caper" his eyes became fixed and his pupils dilated. It was in vain that I tried to impress the parents with the seriousness of the case, but in two years he became an idiot and, fortunately, died.

Not to go further in this direction, we would simply say that the fact of epilepsy does not depend at all on the number or on the variety of the symptoms, but solely on the question whether the symptoms are epileptic or not. If epileptic, the symptoms may be only one or two in number, and both slight and temporary, but that case is a serious case nevertheless, quite as much so as one in which there are violent convulsions, though only at long intervals. The reason is, that epilepsy is a specific disease, and every case of it is a case of epilepsy and of nothing else; no other disease is so protean in the manifestations, and there is none whose manifestations afford so little clue to its underlying cause, for the most diverse forms are often found to become interchangeable with one another. A non-convulsive case may at any time change into a convulsive one, or vice versa. A patient, with complete loss of consciousness, may have attacks in which consciousness is preserved, or he may have what are called co-ordinated attacks, when he walks forth, having stripped himself stark naked, or he may have an attack of epileptic mania; this latter outcome occurs oftener in those who have been subject to non-convulsive attacks, but I had a patient who always first fell in strong convulsions, and then would rise and rush to attack the first person he saw. We have to go deeper, therefore, than the varying symptoms, deeper than its curiously different exter-

nal manifestations, in search of something which neither varies nor differs, but is always present, in every case of epilepsy. If such an element can be found, we are then in line to approach to something fundamental in the pathology of the disease; that there is such an element in epilepsy, an element that is found in no other disease, hence an element which is pathognomonic, we will now demonstrate; and on that account we have directed attention to the nature of the very first symptom of the attack, to show that it is as truly epileptic as any of the subsequent ones. In other words, epilepsy not only begins, but is altogether epilepsy, with the very first symptom. That first symptom is part of the epileptic process, which is like no other process, and needs nothing to make it more complete, even though it shows only one manifestation and stops short at that, like the "caper" in the child referred to. That same first symptom, whatever it be, is epileptic, and nothing but epileptic; none of the subsequent symptoms are any more epileptic than the first one; it was pure epilepsy from the start, just as fire is nothing but fire, whether in the flame of a match or in the subsequent flames of a building, first lit by the match. We shall gain a correct insight into this disease when we recognize that the first symptom is the most important symptom of all, because of its pointing to the one constant element in epilepsy, that element which is never absent in any of its attacks, and which, in short, makes it epilepsy.

That never varying element in epilepsy is *suddenness*. Epilepsy is the only sudden disease; other diseases may be rapid in their onset, but none are sudden except epilepsy. The first onset is always instantaneous, and this fact furnishes the most important clue to the nature; nor is this statement altered by the sometimes prolonged and far-distributed disturbances which follow that sudden onset, any more than one could say when a dam gives way that the greatness of the consequent ruin precludes the explanation that it started with a small leak in the wall; it was an insignificant run of water in the beginning and a deluge at the end, but it was water all the same, and water only, which did it from first to last, so the whole outburst of an attack of grand mal should not confuse us, either by its violence or by its duration, from recognizing its oneness with the gentle ascending aura with which it instantaneously began. Or, we might illustrate it thus, no one stone in an arch is ever isolated or independent of the others, but both receive something from, and give something to, the whole arch; but let one of the stones of the arch be suddenly loosened, then a great commotion follows in the whole arch, not because the arch has received a great shock or impulse from without, least of all because the arch was

composed of explosive materials, but simply because a long-standing, inherent force in it—namely, that of gravitation, for distributing which, in a certain way, the arch has been constructed—has been suddenly liberated from its normal restraints by an abnormal change of place in a single stone. Or, to use another illustration, the propeller of a steamer is fashioned first, and then the power is communicated to it to act against the mighty restraint of the water in which it is immersed. Once on a steamer, as I sat reading in the cabin just over the propeller, the vessel rose so that the propeller for the moment beat the air instead of the water; the whole vessel at once seemed to have a violent epileptic fit, which shook it from end to end; but all this was not on account of a new spontaneous burst of steam from the boiler, it was only the old normal energy acting with the old normal inhibition suddenly withdrawn. These two illustrations of disturbance in physical mechanisms by derangements of regulated physical inhibition may now be properly applied to derangements of regulated inhibition between the various nervous centers in the brain cortex. No functions of a nervous kind are ever performed independently, but only under regulated inhibition by other nervous functions; if it were not for regulated inhibition between different nerve-centers all would be chaos; thus, there can be no general nervous stimulant, because when the flexor muscles, for example, are stimulated to action the corresponding extensor muscles must relax. Nerve-cells store up within themselves nerve energy, but this energy never explodes spontaneously. Hence, how does nerve energy act? *Always according to the first law in the physiology of the nervous system, which is, that the beginning of every nervous act is invariably on the afferent side.* A spontaneous—that is, a primary motor or efferent—discharge is unknown; all efferent phenomena are in response to previous afferent excitation and to nothing else. Why, therefore, should it occur without an afferent excitation in epilepsy? However explosive a nervous discharge may seem to be, still it is by some afferent train that the explosive was lit.

On these lines my definition of epilepsy would be this: *Epilepsy is a disease characterized by a sudden derangement of the normal regulative inhibition existing between cortical nerve-centers, induced, in the first instance, by an abnormal afferent excitation.*

This statement of the pathology of epilepsy shifts the *primary* seat of the disease from the motor or efferent to the sensory or afferent portions of the nervous structures involved, and, by so much, affects all the problems connected with the treatment of the disease. That the afferent origin of epilepsy is no theory is proved by the multitude of

instances in which every one admits that the disease is caused solely by some afferent irritation. Thus, some epilepsies have been caused by the irritation of a thickening in the nose, or by a tapeworm in the intestines, or by a stone in the kidney, and have been cured by the removal of these sources of afferent excitation. But some writers, under the theory that epilepsy is due to instability of the motor centers, try to make these epilepsies of plainly afferent origin, a class by themselves, and call them "reflex" epilepsies, while all other forms they term "idiopathic" epilepsies, which they tell us are of central origin. The term "idiopathic" is itself a confession of theory; but, when this theory assumes that the efferent phenomena are spontaneous and idiopathic, while not a single example can be adduced of efferent activity without its antecedent afferent excitation, this view is simply impossible. This most specific disease has but one mechanism and is always reflex, and in every case our problem is to find what the afferent source of the trouble is.

Treatment.—We should always begin with a careful examination of the patient all over, to search for the possible existence of some one source of abnormal afferent excitation. Such a cause is too often found in an intercranial focus of irritation following upon an injury to the head. The history of a severe fall, it may be years before, is always worth noting, but, in my experience, the same organic cause of an intercranial irritation may be found the sequel of a venous thrombosis in the meninges occurring in the course of one of the specific fevers, such as typhoid fever. One of the most curious instances of the kind occurred to me in a middle-aged woman after an attack of diphtheria. The history of an attack of sunstroke is also not an uncommon antecedent. This entire class of epileptics often admits sensations of discomfort about the head on barometric changes in the weight of the atmosphere presaging a storm, or exposure to the hot sun. I always prescribe for such patients, in connection with other remedies, a long-continued dosing with $\frac{1}{2}$ gr. of mercury biniodid, three times a day, and the application to the mastoid processes and nape of the neck of the biniodid ointment, according to the recommendation of Dr. Fuller, of the London Hospital, many years ago before the bromids were thought of.

One of the most curious of the vagaries of epileptic attacks occurs when the primary focus of irritation is in the nose; they are always associated with growths or thickenings which cause pressure on the ethmoid. Vertigo is a frequent symptom of these cases, with ringing in the ears and sensitiveness to sound. The coma following the attacks is sometimes quite pronounced; a tendency to weep and loss of

memory are very common, but it is remarkable how promptly and permanently many of these patients are relieved by slight operations on the nose. When we consider how intimately the nose is associated with the respiratory nervous mechanism in the medulla, often illustrated in the causation of asthma, the further implication of those centers by similar complications in the upper nasal passages becomes quite probable, and should lead to careful examination of those passages in every epileptic.

The greatest area of reflex excitability, however, in the whole body is in the throat, just at the crossing of the tracts of respiration and of deglutition. The nervous mechanism which presides there over muscular movements may be likened to that of a railroad switch, because it is ever summoned instantly to prevent anything which is to be swallowed from going down the wrong way into the larynx; rapid eating and drinking, therefore, keeps that nervous mechanism in a constant state of excitement, and I have met with many cases in whom the first epileptic attack was caused by their habitual hurry in this respect. Nothing is more common than to find excitability in the throats of epileptics. I have no doubt that their common habit of bolting their food before it has been sufficiently masticated is often due to their inability to keep from swallowing so soon as a morsel passes near the posterior surface of the tongue. I would recommend in such patients the application to the whole pharynx of a solution of silver nitrate, 10 gr. to the ounce, once a week, and, after a time, the tincture of iodine instead.

The gastro-intestinal tract is well known as the seat of afferent irritations whose radiations may be wide enough. We need not be surprised, however, that the precise focus here may elude our search, because a large proportion of them may start from some hidden branch in the great distribution of the vagus. Sometimes the characters of an aura may afford a probable clue here, as they may do on further investigation in intercranial cases, but the whole mechanism of auras needs more study than has been given to it. In all epileptics troubled with constipation I prescribe the constant use of belladonna.

On the other hand, the transmission of a normal afferent impression frequently can be prevented or turned aside, so to speak, by an artificially induced counter-impression. Acting on this principle, I have for many years employed the red-pepper pack to the whole surface of the body, of an infusion of the strength of 1 dram to the pint of boiling water, and applied until the whole skin is reddened. At one of my clinics I had a confirmed case of a boy, aged ten years, who had daily

attacks. I told the class that, to test the effects of this measure, I would give no medicine, but would prescribe the pack, with directions to the mother to report at the end of the week on the number of fits. She did not return for five weeks, and explained her absence by saying he had not had a fit until the previous day. Medicinally, the action of our most widely accepted remedies would seem of itself decisive as to the primary afferent seat in the nervous system of the disease. Thus, the bromids, according to the universal consensus of experimenters, act upon the peripheral sensory apparatus exclusively when administered to animals in doses corresponding to therapeutic doses in man. Under their influence a rabbit may have its reflex excitability wholly abolished, and yet, when alarmed, it jumps vigorously, thus proving that its cortical efferent functions are intact. In man, if a patient shows such excessive excitability in his pharynx that you cannot touch it with the mirror of the laryngoscope, a dose of 30 gr. of potassium bromid will soon enable you to make the examination without trouble.

The bromids, however, are too often administered very carelessly, just as though they were specifics for every case; but, as they have to be administered in free doses for long periods, for two years at least, we should never forget that they are unnatural to the body, and, therefore, sooner or later, they will act as poisons. As soon as they do so, which is shown by the specific poisonous symptoms known as bromism, they rapidly lose their remedial properties; it is our duty, therefore, to postpone bromism as long as possible by careful attention to the general health of the patient, and by counteracting the deleterious influence of the drug on the blood. For this purpose I would strongly advise the administration of cod-liver oil and the preparations of phosphorus along with the bromids.

There is no reason why the peripheral sedative effects of the bromids should not be reinforced; failure with them is like failure with quinin in ague, sometimes real, but oftenest owing to faulty administration.

Experience has also shown that antipyrin and phenacetin are valuable adjuvants to the bromids. Antipyrin may be given in 10-gr. doses and phenacetin in doses of from 10 to 20 gr. with each dose of the bromids. The ammonium bromid appears to be the preferable salt in such combinations. When the attacks are nocturnal, chloral is also indicated, and may be taken in doses of 10 gr. at bedtime.

The great aim, however, in the treatment of epilepsy is prophylaxis. Anything which increases the intervals between the attacks is so much

gain against the evil of pernicious habit. Mere routine administration of drugs and undue reliance on them alone is the chief cause of want of success in the treatment of this deeply seated disease. An epileptic should always be regarded as having a profoundly defective constitution, and no measure should be neglected to discover any cause of ill health in him. Now one of the commonest causes of ill health is toxemia from auto-infections. Blood-poisons may at any time of life cause a person to acquire epilepsy; these attacks are then often termed "epileptiform," but there is no such thing as an epileptiform convulsion, even in infants. These attacks are just as typical in their clinical accompaniments as any attack of grand mal, with the same biting of the tongue, clonic spasms, and subsequent coma, and all the other details that ever occur in an epileptic paroxysm. The toxemia which produces them may be temporary, but that does not alter the nature of the attacks themselves. All that is needed to have them graduate into the full degree and letter of epilepsy is to have them occur often enough to establish the epileptic habit. That they often do so, in the case of infantile convulsions, is well known. And the reason why epilepsy is more difficult to cure the younger the patient, is because that is the age for easily contracting life-long habits of every kind.

It is in the gastro-intestinal tract that the source of the commonest infections is to be found. Hence, the prime importance of diet in the treatment of this disease. I always tell patients that they cannot get well if they continue to be hearty meat eaters. Thus, carnivorous animals, when they die from natural causes, die most commonly from epilepsy, and the difference between them and the herbivora in proneness to convulsive attacks is known to all. So far as my experience goes, a return of the disease has been too often the case in patients who have resumed a meat diet to make me doubt the reason. I have a striking illustration of this in the case of 32 epileptic inmates in the hospital for the insane, Ward's Island, N. Y. I had regulated their diet by cutting out all meat for some months, until Thanksgiving Day, 1907, when I was petitioned to allow them to have the usual Thanksgiving dinner; this they partook of very heartily, with the result that 30 of the 32 had a return of their epileptic attacks the very next day. Moreover, everything indigestible, whether on general or personal grounds, should be avoided by the patient, particularly at the evening meal.

Intestinal antiseptics are always prescribed by me, sooner or later, in treatment, particularly if a bad breath accompanies or follows the attacks, and also in those cases characterized by attacks coming in

groups. The best intestinal antiseptic that we possess is a calomel purgative, consisting of 5 gr. of calomel and 35 gr. of compound jalap powder, to be given once or twice a week, and to be followed by 10 gr. of the benzoate and 10 gr. of the salicylate of soda, an hour after each meal.

After an experience of fully forty years in the treatment of this disease I would state the prognosis for complete cure, in average cases, to be quite 70 per cent. The chief reason why the percentage of actual cures does not ordinarily reach that figure is owing to the difficulty of getting the patient to persevere in the whole details of the course; after a more or less prolonged freedom from the attacks, they grow careless and neglectful. They should be enjoined to regard themselves as still epileptics until at least fully two years have lapsed from the last sign of an attack, and after that they must for life continue to be cautious in their conduct. Still there remain those in whom the epileptic habit has been engrafted upon a poor constitution from youth; but even in these, it is encouraging to know that many of them can be cured altogether, as I know personally to have occurred in a number who have been under my observation from ten to more than twenty years.

CATALEPSY

Cataleptic attacks are not unknown in hysteria, which disease may imitate anything, but a true instance of catalepsy I have seen but once, and that in a man who was brought by two policemen, who found him sitting on a bench near the Central Park. As the policeman thought his posture strange, he asked him what was the matter, but, though the man seemed conscious, he did not speak. The policeman then partly raised him from his seat, but on letting go he remained in that posture. He then raised one hand partly above his head, and it stayed put; the same way with the leg on the opposite side. Putting him in an ambulance, they took him to the Roosevelt Hospital, where the house staff were equally puzzled with him, because he seemed to be a perfect manikin. I then happened to drive up in my carriage, and began to examine him myself. Just as one of the policemen, with bated breath, asked me if he were "possessed," I answered that he was, but that we would soon dispossess him, and ordered that a cold steel sound be passed into his bladder. This procedure immediately brought him out of his condition, and he soon left the hospital apparently as normal as ever.

INFANTILE CONVULSIONS

Epileptiform convulsions are very common in children, owing to the disproportionate development of the brain in childhood. A not-

able rise in the temperature of the blood at the onset of the specific fevers, such as in pneumonia and scarlet fever, predisposes to such convulsions. One of the commonest causes of such attacks is from derangements in the alimentary canal, whether from improper diet or overfeeding. The indication then is to remove the offending materials by a dose of castor oil.

We should be particularly careful to forestall the formation of the epileptic habit, because many cases of epilepsy in after years have a history of frequent infantile convulsions in the first to the third year of life.

Treatment.—The principles of treatment, however, do not differ from those which we have already detailed for the management of epilepsy itself, other than their modification according to the age of the patient.

VERTIGO

Following naturally upon the consideration of epilepsy comes the subject of vertigo. Not that there is any relation between these two disorders, but because in vertigo we have the most striking illustrations that we are physically directed by the afferent element in the nervous system, that element which is so often overlooked in the study of epilepsy.

How do we maintain our balance when we stand? By a constant exercise of the motor or efferent nerves of our muscles. A great array of actively contracting muscles work together to keep us erect while we stand, and to prevent us from staggering when we walk. All this is due to unremitting efferent activity, and, at first sight, seems to show that the efferent is the dominating power in the nervous system. But the first case of vertigo shows that this is a mistake. No efferent action occurs without an afferent excitation precedes it.

The whole great array of muscles concerned in maintaining the body in equilibrium may be disturbed in their action by lack of information from the afferent sources of the eyes, of the semicircular apparatus of the internal ear, or from suspension of the muscular sense.

Thus, as to the eyes, I once climbed the Great Pyramid in Egypt, to find that when I reached the great stone on top, although it offered a surface of some twenty feet square to stand upon, I could not do it, but forthwith sat down, because all the muscles of my legs were in a state of helpless tremor. This was not at all from fatigue, but simply because my eyes, for the first time, were looking into nowhere whichever way I turned, and, therefore, could not tell my leg muscles what to do. Just the same kind of dizziness occurs to many persons as they

stand on the brink of a precipice, though here the lack of afferent impressions is only half in its extent compared with what it is on the pyramid.

The mental condition at such times, as it is in all vertigos, is that of great alarm from fear of falling. This is so instinctive that there is no use trying to overcome it.

But the worst sensation of vertigo comes from disturbance of afferent impressions in that remarkable apparatus for maintaining equilibrium, the labyrinth of the internal ear. Here are three tubes containing fluid, which cross one another according to the three dimensions of space, and the movements of that fluid tell the cerebellum how the center of gravity is affected by every bodily movement. Any accident to these tubes, whether from external violence or from hemorrhage into them, produces a most dreadful sensation, which, indeed, may be followed by death.

Muscular sensations may be suspended by disease or by poisons. A familiar example of the latter is afforded by alcohol, which has the property of paralyzing, not the efferent muscular action, but the afferent sense in the muscles themselves. The effect is that the drunkard is distressed with an ignorance of the whereabouts of his legs, and, therefore, staggers, but a like suspension of the muscular sense occurs in disease, as in tabes, giving to this complaint the name of locomotor ataxia.

The auditory or eighth cranial nerve when it enters the skull is composed of two parts, which differ wholly in function from each other. The first division, or the auditory nerve proper, goes to the cochlea, to be there finally distributed to the organs of Corti, which is the apparatus for hearing. The second is the vestibular nerve, which primarily has nothing to do with hearing, but is the nerve for equilibrium. Its distribution is largely in the semilunar canals.

The vestibular nerve enters directly the lateral side of the pons and terminates in two groups of cells, the cells of Deiters and Bechterew's nucleus, and the cells of the posterior nucleus, lying upon the floor of the fourth ventricle. The cells of Deiters' nucleus form the most remarkable set of connections in the body, especially with the cerebellum, that great organ of muscular co-ordination, with the nuclei of the oculomotor nerves, the sixth, fourth, and third, with various nuclei of the tegmentum, and with the olivary bodies. Some fibers of Deiters' nucleus pass downward to the nuclei of the cervical nerves of the spinal cord, and connect with the motor nuclei of the head and back. The posterior nucleus of the vestibular nerve connects not only

with the most important parts of the cerebellum, but also with the upper portion of the brain axis, the corpora quadrigemina, corpora geniculata, and the optic thalami.

We can well understand, therefore, how serious must be the results of any widespread disturbance of these great afferent nerve-centers. Vertigo, thus produced, is accompanied by great mental terror and vomiting, with rapid action of the heart, relaxation of the blood-vessels, with sweating and great faintness. This is well illustrated in Ménière's disease, caused by hemorrhage into the semicircular canals. This may occur suddenly in perfect health, or, more commonly, be preceded by ear disease or by arteriosclerosis. It may be followed by permanent deafness. Any mental exertion may bring on an attack, so that the patient lives in constant terror of them. I once had a well-known clergyman who consulted me about them, and I could not help pitying him in his distress. He finally died in one of these paroxysms. Nystagmus, or rolling of the eyeballs, is a common accompaniment.

Treatment.—The treatment of vestibular vertigo is by absolute and prolonged rest in bed and by blisters behind the ear, along with doses of 15 to 20 gr. of strontium bromid, with 10 gr. of chloral, an hour after meals and at night, while the only nutritive administrations should be a wineglassful dose of equal parts of milk and lime-water every two hours.

Babinski and Putnam have advised lumbar puncture in treatment of all vertigo, and report success. From 10 to 15 c.c. of spinal fluid is withdrawn, and after a week this has to be repeated if necessary.

Voltoini has reported an affection which he considers due to primary inflammation of the labyrinth. This disease occurs mostly, but not always, in children. Like acute meningitis, it begins suddenly with high fever, delirium, vomiting, and vertigo. After a few days these symptoms subside, but the child still suffers from dizziness and staggers in walking, while it is found to be deaf. The staggering gradually passes off, though some degree of deafness remains. The lesions found have been plastic exudations, with destructive processes in the semilunar canals.

The treatment should be by counterirritation about the ears, purgatives, and bromids in large doses.

Vertigo may be caused by trauma of the vestibular nerve. Thus, Starr ("Nervous Diseases," page 849) records the case of a fireman, seen at the New York Hospital, who by a fall had fractured the base of his skull and torn the left auditory nerve. This caused an absolute deafness in the left ear, a constant agonizing sensation of the rotation

of the body in its longitudinal axis. Unless firmly held this man constantly revolved upon his bed, complaining all the time of the most intense distress. His vertigo was attended by extreme exhaustion, vomiting, rapid pulse, and in three days he died from heart failure.

Vertigo is a frequent symptom in diseases of the pons varolii. Thus tumors upon the base of the brain, syphilitic exudations, or vascular lesions in the pons and abscesses or tumors in the cerebellum irritate or destroy the vestibular nerve or its nuclei. The vertigo is by no means so severe as in Ménière's disease, but is shown by a tendency to stagger to one side. In such cases the presence of other cranial nerve symptoms usually aid in the diagnosis.

Vertigo is sometimes caused by accumulations in the external auditory canal, which produce pressure upon the tympanum that is transmitted by the ossicles, which connect the tympanum with the fenestrum ovalis. This pressure, therefore, may be thus transmitted through the fenestrum ovalis to the fluid contained in the semicircular canals of the labyrinth, sufficient to cause both vertigo and staggering.

I once had a man brought to my clinic with the diagnosis of locomotor ataxia because he staggered so. On examining his ears I said that we would cure this locomotor ataxia then and there by a basin of water, because his ears were stuffed with hardened wax. After prolonged syringing the wax was removed, and he walked out with no more ataxia. But pressure of this kind may be caused by any affections of the middle ear, such as by accumulation of pus or blood in the middle ear, and are to be treated by incision into the tympanum. Vertigo may also be a comparatively trivial trouble, caused by arteriosclerosis, and is, therefore, not uncommon in elderly persons, particularly on their sudden rising or even while walking. In such cases the arteries are to be carefully examined, and if signs of arteriosclerosis, with high tension, are present in them they should be treated with from 10 to 15 drops of the tincture of aconite four times a day, coupled with 15-gr. doses of strontium bromid.

Vertigo is not uncommon in functional derangements of the alimentary canal, the accumulation of gas with hyperchlorhydria in the stomach often causing dizziness, which may be relieved at once by a teaspoonful of aromatic spirits of ammonia in a wineglassful of water. This causes eructation of the gas and counteracts the acidity with speedy relief. Some disturbances in the lower intestine also cause momentary but severe vertigo, with a tendency to fall forward. This is due to fermentation in the intestine, and is quickly relieved by 10 gr. of urotropin with 10 gr. of benzoate of soda. All these forms recently

mentioned of vertigo do not cause any pain in the ear or deafness, and, least of all, vomiting.

HYSTERIA

Our composite nature is made up chiefly of two elements—the intellectual and the emotional—and persons differ from each other according to the predominance of one or the other element. This becomes all the more apparent in morbid conditions. Hysteria may be defined as a state similar to that of a person who, we say, is carried away by his emotions. It is, therefore, much more common in women, though men are by no means exempt. It is also more prevalent among Latin than Teutonic races. The parallels between emotional and hysteric states are numerous. Thus, under strong emotion the voice trembles or even becomes abolished, and aphonia is a well-known accompaniment of hysteria. I have known strong emotion to suspend the sensation of pain; for example, in my experience more than one soldier in battle was wholly unaware of the reception of a serious wound. Similarly, areas of anesthesia of the skin are well known sometimes in hysteria. The emotion of fear may temporarily paralyze the leg, and just such paralyses occur in hysteria. As we proceed we shall find so many other parallels between emotional and actual hysteric states that we might truly say that a hysteria is a condition of diseased emotional excitability. This principle has much to do with the treatment. Thus, a person may keep his thoughts to himself, but, unless endowed with a strong will, cannot escape showing his emotions. In hysteria the will is weak and the emotions rule, but, as the emotions crave company, so a hysteric cannot abide being alone. Moreover, there is nothing worse in the management of a hysteric person than manifestations of sympathy, and many a hysteric girl cannot be cured until she is deprived of the sympathy of her mother or other members of the family by removal from home.

The rule in hysteria is that it especially prevails in neuropathic families who are easily swayed by their feelings, and who are not properly trained in self-restraint. It cannot be too clearly emphasized that hysteria and a strong will do not go together, and that every means should be taken in such patients to develop the power of the will.

It should be stated, however, that obstinacy is not synonymous with will power, but may coexist with real feebleness of purpose and of sustained effort. The mistake, however, should not be made that hysteric symptoms, whether motor or mental, are in themselves imaginary; instead of that, they are real, as shown by the conditions found in the larynx in hysteric aphonia. At such times, when the laryngoscope

is used, the vocal chords are found to be absolutely paralyzed. Of course, the patient has never seen her vocal chords, and, therefore, cannot voluntarily paralyze them. Hence, the paralysis of these chords is real and not imaginary, and what is true of the larynx is also true of a leg paralyzed in hysteria. Likewise, it is very unnatural to infer that the varied mental phenomena of hysterics are imaginary. A hysteric woman will be most voluble in descriptions of her sufferings, and puzzle an inexperienced physician with their variety, and, according to her statement, with their severity, but one feature of this condition is that new pains, aches, or disabilities can occur by simple suggestion. Let the physician gravely state that she has omitted to mention some disability of her knee-joint, and forthwith she exclaims that she has it.

Motor Phenomena.—A woman, after a quarrel with her husband, had her jaw locked by trismus. Shortly afterward her husband entered, whereupon her trismus immediately relaxed, and she began to have universal contortions, writhing like an eel, as her physician described, and tearing her clothes to tatters. After these clonic convulsions, which lasted an hour, she apparently became comatose from exhaustion, in which state she continued for two hours, and then became herself again upon passing a large quantity of limpid urine. In many of these cases of hysteric convulsions it is curious that, after their subsidence, the patients have no recollection of what they have done. In this respect hysteric convulsions resemble those of epilepsy, so that a special division has been made by some neurologists and termed "hystero-epilepsy." I do not regard these cases as at any time verging upon true epilepsy, for the attacks are never so sudden as in epilepsy, do not come on in sleep, do not cause the patient to fall, or, if they do, they take care not to hurt themselves by striking surrounding objects.

Every form of organic mischief in brain or spinal cord can be imitated by hysteria, but there will always be lacking certain features of organic paralyses in hysteric affections which simulate them. Thus, in hysteric hemiplegia the face escapes, as it never does in the organic form. Hysteric hemiplegia is not nearly so common as monoplegia. Of the monoplegias, the commonest involve one leg. This may come on slowly or suddenly, the gait being very characteristic, for the patient does not swing the leg as he does in hemiplegia, but has a foot-drop in the line of walking. When one leg alone is affected the symptoms are often preceded, for a greater or less length of time, by other hysteric manifestations. Nearly always there is a loss of sensation in the affected limb, which may even exceed the motor paralysis. Hysteric

paraplegia has much the characteristics of monoplegia, but may cause some uncertainty in diagnosis, owing to the bladder being apparently involved. There is always, however, one important sign present, that in hysteric paralyses of limbs wasting and atrophy never occur, nor does coldness of the limbs, and the electric responses are usually normal.

Hysteric Contractures.—These curious manifestations may occur anywhere in the body, from the jaw downward, and a remarkable feature about them is that they sometimes persist for months or even years, and then show their hysteric character by disappearing without cause. Of these contractures, a good example is found in the arm, which is flexed at the elbow and wrist, while the fingers tightly grasp the thumb in the palm of the hand. One of the most disconcerting cases, in my experience, was when I was invited by a friend, who was an eminent gynecologist, to attend an operation on a tumor in the abdomen, which he had diagnosed as an ovarian cyst. When the patient was anesthetized the tumor vanished. These phantom tumors are caused by temporary contractions in the muscle walls of the abdomen, but they have been known to occur in the pectoral muscles.

Contractures in one or in both legs are very common, and may persist for months, the diagnosis of their hysteric nature being possible by the absence of wasting in the contracted part.

As a part of their spectacular tendency some hysteric patients are prone to deceive, so as to excite sympathy. Thus, some of them have been known to drink urine so as to vomit it. Another leading characteristic of these patients is their selfishness, which causes them invariably to shirk their ordinary duties, on the plea of their being so extraordinarily affected. A truly unselfish hysteric is unknown. The passion for display leads sometimes to attempts at self-mutilation. I once had a hysteric woman who introduced 106 needles into her knee, which were only discovered when the surgeon proposed to amputate the limb.

Anesthesias.—Hysteric anesthesias may be strictly localized or very general, usually, however, developing on one side of the body. They are often of use in diagnosis, because they do not occur in the skin areas involved in anesthesias of organic origin. When extensive, the skin feels cool, and a prick with a pin does not draw blood.

Hyperesthesias.—Corresponding to the regular cutaneous anesthesias, there are patches of hypersensitiveness on the skin, pressure on which may bring on a regular attack of hysteria. These are specially frequent when pressure is made in the region of the ovary. A pain,

however, develops in the course of the sagittal suture of the cranium, and is called the *clavus hystericus*. It usually is accompanied by great mental excitement and screams so long as spectators are about.

The breathing is often deranged in hysteric attacks, the respiration being very gasping, or the breath held until the face becomes cyanosed. I was once called in consultation by two physicians to see a patient who had not left her bed from paralysis for eighteen months, but the night before she summoned all her friends to see her die of suffocation. I ordered every person, including the physician, to go out of the room, and then went up and pulled her out of her bed into the middle of the room, then left her standing there and told her to walk back to the bed, which she angrily did. I then told her that she could walk anywhere, and so in a week she went to church.

Hysteria may occur at any age, for I have seen hysteric anesthesia in a child of only ten years and a typical hysteric emotion in a woman of sixty-five. In children, however, it is often due to simple imitation, and epidemics of hysteric attacks are by no means unknown in boarding schools. A medical friend of mine once stopped such a series of outbreaks by pouring a bucket of cold water over a girl in the presence of the school, and threatened to repeat this performance on the next girl who became hysteric.

Treatment.—As to treatment, the first indication is to secure a regular and healthy action of the bowels. In the majority of these patients the bowels are obstinately constipated, and disorders of digestion are the rule, but always without any true symptoms of inflammatory disturbance. The most trustworthy medicinal remedies are of a stimulant kind, such as *asafetida*, *valerian*, and *camphor*. A prolonged course of these remedies, combined with powdered *rhubarb*, *soda*, and other intestinal antiseptics, is advisable. Usually the antispasmodics, as they are called, such as *asafetida* and *valerian*, are employed only occasionally, when, to do good, they should be given systematically daily for weeks at a time.

A course of 5 gr. of the sulphocarbolate of soda, with 1 gr. of *camphor* and 3 gr. of powdered *asafetida*, in two capsules, may be given three times a day an hour after meals, to be followed, after two weeks, by a prescription of a dram of the valerianate of zinc and 10 gr. of powdered *aloin*, made up into twenty silver-coated pills, one to be taken four times a day.

PARALYSIS AGITANS

Paralysis agitans, or shaking palsy, also called Parkinson's disease, as he first described it in 1817, is an affection with very characteristic

symptoms, consisting of coarse tremors at the rate of six vibrations a second. It affects men more than women, very rarely before thirty, and most commonly after forty, years of age.

Some writers speak of it as an aggravation of ordinary senile tremor, but this is a mistake, for it does not begin as such tremors do, nor do they end in the characteristic general muscular rigidity of this affection.

The only common antecedent is a localized trauma, such as a blow on the shoulder or a wrench of the hand, from which the disease is slowly propagated, with all its special symptoms, to one part after another, till the whole muscular system becomes involved, with the exception of the muscles which move the eyeballs. Every affected muscle then behaves, in turn, as the first did, never changing into any other muscular affection; all of which goes to show how specific the malady is.

Numerous and exciting causes of the disease are mentioned by writers, such as emotional shocks, fright, worry, or anxiety or exposure to cold, overwork and hardship, or following infections, such as grippe, typhoid, or pneumonia. These can only be ranked as contributory causes, because they may every one of them occur without causing paralysis agitans, which fact becomes quite plain from the following recital of the symptoms of the disease.

Symptoms.—The symptoms consist of rhythmic contraction of the flexors and extensors, never violent nor spasmodic in character. They can be arrested at the beginning for a brief period by the will, but then they quickly return, and are just as evident during periods of rest. They cease during sleep. The marked peculiarity is that they begin most frequently in the arms or hands, one being affected for some months before the other. No explanation can be furnished any more than for the rest of the features of this disease. Rather uncommonly the beginning is in the legs. When it begins in the hands the index-finger and thumb are usually affected before the other fingers, when the patient, by pressing the thumb against the first finger to stop the tremor, makes the pen-posture of the hand quite characteristic of the disease. Either exercise or passive movements often temporarily mitigate the tremor, and so does the vibration of a railway train. One of the first effects of this condition, if the tremor has begun in the right hand, is to alter the hand-writing, which exercise in time becomes impossible. There is always an extension of the tremor from the part first affected to other parts, until, in the end, all the extremities are affected. Usually the tremor extends from an arm to a leg of the same side, but sometimes it appears in the other arm before the leg is affected.

Ordinarily, one or two years elapse before an extension to a second limb is noticed. Finally, tremor of the head sets in, often with a tremor of the jaw or of the lips and tongue.

There now follows the second marked feature of the disease, namely, rigidity. This usually appears first in the movement of the head and neck, the patient turning his eyes by moving the body with the head, as he finds difficulty in independent movements of the head and neck. This rigidity soon extends from the neck to the extremities, and finally to every muscle of the body. The head is then bent forward, the arms usually being held to the sides, with the elbows flexed, the wrists extended, and the first phalanges flexed. Abduction of the thighs is hampered, and, in walking, the knees are approximated, while the steps are short. The facial muscles also become stiff, so that the face has no expression from immobility of its muscles. Finally, even the vocal chords become stiff. In some the speech is monotonous or very weak and feeble, with jerky pronunciation, and occasionally the patient talks only in whispers. This general rigidity hampers all movements, so that in walking the patient bends forward and often hurries his steps to keep from falling, so that he frequently catches hold of an object to prevent this. In short, there is an abolition of the instinctive movements of the body to keep it in the erect position.

Meantime, it is remarkable that the muscles do not waste nor show tendencies to fibrillary twitching. There is no muscular atrophy nor any changes with electric currents. The deep reflexes are usually normal or in a few cases exaggerated. One of the most distressing accompaniments of the rigidity is the presence of an aching feeling all over the body, producing a constant sense of restlessness, so that the patients think that they will obtain relief by change of posture. This aching is usually dull, and does not often amount to pain, but is frequently accompanied by paresthesia, such as tickling or tingling, numbness, or sensations of heat and of cold, either in the shaking limb or all over the whole body. The most common sensation is a burning feeling in the skin, which may feel quite hot to the touch, though there is no fever. There is never any anesthesia, but occasionally considerable sweating. The functions of the bladder and rectum are not affected, but, with restless patients, insomnia is often troublesome. Though authors maintain that paralysis agitans is never a fatal disease, my own experience is quite different, death being usually preceded by symptoms of general exhaustion.

In a few cases the development of rigidity precedes that of tremor. From the foregoing account of the symptoms it seems plain that paral-

ysis agitans is a disease *sui generis*, and that its pathology is still unknown. In some cases, however, complete change of surroundings causes remarkable improvement in the condition of the patient.

GASTRIC AND OTHER NEUROSES

There is a great contrast between the organs of the thorax and those of the abdomen in their relations to general vitality. However immediately necessary to life the heart and the lungs may be, yet even serious organic changes in them may exist without causing much anxiety in the subjects. A patient with a large tuberculous cavity in his lung is often sanguine about his recovery. So, when medical students are frightened by palpitation of the heart, it is fair to infer that they have only dyspepsia, because valvular affections of the heart do not commonly cause apprehension.

Far otherwise is it when anything happens below the diaphragm. The one word which then describes the effect is "alarm." Even the simplest functional disorders of the stomach produce depression of the spirits; but still more profound is the effect of a lesion involving the stomach wall, for the smallest hole through it causes immediate collapse. So far as danger to life is concerned, a surgeon would rather amputate a leg than make a small clean incision in the perineum for extracting a stone from the bladder.

The reason for all this lies in the relations of the abdominal nerves and their ganglia to life itself. Purely functional derangements in the abdomen, unaccompanied by any discoverable anatomic changes, will yet occasion a greater variety of distressing symptoms than functional disorders anywhere else in the body. On that account no disorders so often present such difficulties in diagnosis. Hysteria, for example, can imitate everything, including death, and hysteria has its origin, as we shall see, in disturbance of the abdominal sympathetic.

Gastralgia.—All this is well illustrated in that neurosis of the stomach called gastralgia. In a typical case the patient is suddenly seized with severe pains in the epigastrium, which radiate to the back round the lower ribs. The attacks are definitely paroxysmal, and may be separated by long intervals. The patient describes the pains as agonizing, and demands immediate relief, while the physician may be well perplexed about the diagnosis, and, therefore, as to what he should do. Just such symptoms accompany gall-stone colic when this occurs without jaundice, in which also hyperacidity may be associated with gastric atony, or similar attacks occur in connection with gastric ulcer, and, like many cases of gastralgia, are relieved by taking some food.

Another trouble must be borne in mind, and that is, the intermittent gastric crises of *tabes dorsalis*. All these, however, have other and characteristic symptoms not present in true gastralgia, and upon them a differential diagnosis can be made.

Gastralgia occurs chiefly, though not exclusively, in women. But in both sexes other manifestations of nervous conditions are present, such as unnatural excitability, both physical and mental. Taking of food in small quantities usually gives relief for a time, and the attacks supervene ordinarily when the stomach is empty. Rumbblings of gas in the stomach are frequent, and eructations give relief. Vomiting, however, is uncommon, while both chills and vomiting often occur with gall-stones.

Other gastric neuroses are sudden attacks of excessive hunger, frequently nocturnal, to which the term "*bulimia*" is given. This is very common in Graves' disease. It may occur in diabetes, but then it is not so paroxysmal. The same may be said of abnormal hunger in epilepsy or even, though rarely, in cerebral tumors.

Dr. T. Clifford Allbutt ("*System of Medicine*," vol. iii, p. 405) speaks of *enteralgia* as the most terrible of all neuralgias. He describes it as occurring oftenest about the navel, and then radiating to the spine, often involving more than one spinal segment. I have never seen a case of this complaint, but as one of his patients finally escaped recurrence of the attacks when she developed articular gout, I suspect the whole trouble was gouty. Ordinary articular gout frequently sets in during the night, with excruciating pains in the joints, and I can imagine an analogous connection of this complaint with true visceral gout. England, whose people more than any other consume beers and ales, is, therefore, the home of gout, and thus may be the country of *enteralgia* also.

But the term "*neuralgia*" is so often loosely used that it should be defined here. It means a pain located in a nerve which, however, is not inflamed. The pain of inflammation is always increased on pressure and by movement of the part, but gastralgia, like other neuralgias, is increased by neither pressure nor movement. The patients instead often press down on the aching part, and the muscles over the affected part are not resistant or rigid, as they always are in ulcer or true gastritis. The term "*trigeminal neuralgia*" is, therefore, a true neuritis, and should be treated accordingly. The same may be said of *brachial neuralgia*.

The term "*neuralgia*," therefore, simply means an aching nerve and not an inflamed nerve. Neither are the severe pains which accompany

degeneration of nerve-tracts, such as those in tabes, properly neuralgic, because well-defined organic changes accompany the pains. Such changes are absent in a true neuralgia. But what makes the nerve ache? An old saying is perfectly true, that neuralgia is a cry of the nerve for better blood. It is a blood disorder, and not a nerve disorder, and in every case is due to a functional blood-poison whose action presents no perceptible anatomic changes. The importance of this principle is great. Thus, there is no more pronounced nervous disease than melancholic insanity. But the brain is not at fault in this terrible affliction. The most careful inspection in melancholia fails to show the least change from a normal brain. Melancholia is, therefore, a blood disease, and I have had much more success in treating it as such than by using any agents that act on the nervous mechanism itself.

These facts do not make the treatment of gastralgia or of any neuralgia a simple matter. An inflammation we can treat at once, but a pronounced neuralgia means that we must treat nearly all abdominal functions together. We should first begin with all the disorders of digestion, for the alimentary canal is our blood-making factory.

Dyspepsia.—A proportion of cases of nervous dyspepsia are dependent upon purely mental causes, such as worry or too continued routine in life, when a vacation or change of scene will accomplish what years of treatment at home have failed to do, as we have already mentioned in speaking of the effect of change. In many of these cases, especially in women, the appetite has long been absent, so that they eat very little. Weir Mitchell's treatment of rest in bed, with stated feeding, will frequently accomplish wonders. Among the functional disorders of the stomach we meet with cases of hyperacidity or hyperchlorhydria. This can be determined only by examining the contents of the stomach after a meal. And in them, besides the other general treatment of the neurotic condition, alkalis, either in the form of magnesia or bicarbonate of soda, should be given in large doses at the height of digestion rather than on an empty stomach. In such cases also urotropin frequently gives relief taken before food, beginning with 5 gr. and gradually increased. The diet should be mainly albuminous, while alcohol should be avoided. Starchy foods should be sparingly allowed, fats being, on the other hand, fairly well borne. Dyspepsia associated with hyperacidity calls for a strictly meat diet, best given with scraped raw meat in small boluses rolled in cracker crumbs. As much as $3\frac{1}{4}$ oz. of meat may thus be given, spread, if need be, between two thin slices of bread and butter. Purely albu-

Loss or weakness of self-control may, however, be congenital, and illustrates the old joke that one should be careful in the choice of his parents. In all such cases the judicious physician should know what to do, namely, begin to cultivate self-control. This can be developed by the proper exercise of the faculties, just as the muscles of the calf of the leg can, by proper dancing, be very different from the same muscles before. This is one of the most encouraging facts about treatment of all cases of so-called neurasthenia.

One of the commonest causes of neurasthenia is from sexual abuse about the age of puberty, of which masturbation is the most frequent cause, and which is by no means limited to the male sex. I have known of nurses teaching this practice to boys only three years old, but in after years it is so thoughtlessly indulged in that parents, and particularly fathers, are truly reprehensible for not informing their sons of what a dangerous and ruinous practice it is. After masturbation has been indulged in for some time, even if it is broken off, it may leave a permanent weakness of the sexual organs, causing afterward prolonged nocturnal emissions and spermatorrhea to occur even in the daytime. No such wretched neurasthenics are to be found as these, a prey to all quacks and charlatans, who make them actually hypochondriac in their fears of approaching impotence or insanity. One effect, I have found, is an irritability of the muscles in the perineum, particularly after long sitting. Students are thus prone to have sexual ideas enter their minds while at their studies. I have found benefit from a pad tightly pressed against the perineum by means of an apparatus consisting of a broad band around the waist, with a pair of straps brought up from the perineal pad and fastened to the abdominal belt by buckles. Cold-water douching of the privates night and morning is beneficial.

Neurasthenics are very common among women, with whom loss of control of the emotions is natural, and has a great deal to do with the genesis of hysteria and all its multiform manifestations.

Treatment.—We have already alluded to the great effects of change, as such, not only in the treatment of nervous, but actual nutritional, diseases. In many cases of aggravated neurasthenic states the patients should have everything about them changed. They should be removed from their families, and in the regulation of their diet and ordinary hygiene be placed in different surroundings from those to which they are accustomed. This is the secret of the justly celebrated Weir Mitchell treatment, but, after all, the fundamental principle here is to develop self-control of both bodily and mental habits.

In many cases of neurasthenia preparations of the glycerophosphates of lime and of soda are of service, of which the following formula may be tried:

WINE GLYCEROPHOSPHATES (*Calcium and Sodium*)

℞. Calcium glycerophosphate.....	gr. lxxiv;
Sodium glycerophosphate.....	gr. ccxxiv;
Vin. Malaga.....	ad. Oj;
Flavor.....	q. s. —M.

Sig.—Dose, $\frac{1}{2}$ oz.

MIGRAINE

This is pre-eminently a class disease, which fact goes far to explain both its nature and its etiology. Thus, whole classes of persons may not suffer from migraine at any time in their lives, such as sailors, farmers, and mechanics who pursue their avocations in the open air. On the other hand, students, scholars, housewives, and needlewomen are among its worst victims. Many eminent men have fully described the symptoms of migraine as they occurred in their own persons, such as Sir John Herschel, Wheatstone, and Walliston. The explanation of this fact is that migraine does not attack those who have an active portal circulation, while sedentary persons are quite prone to it, the reason being that the liver contains at all times one-quarter of the mass of the blood, but this blood is prone to relatively slow movement, because the whole portal circulation is a department intercalated on the venous and not on the arterial current, and hence requiring the adjuvant action of the diaphragm in respiration, supplemented by the contraction of the abdominal muscles to maintain its activity. Being an intermittent affection, it cannot properly be called a neurosis, since it is virtually a toxemia dependent upon a special poison circulating in the brain. By analogy to other selective nerve poisons its amount may be relatively small, accumulating slowly in the blood until it explodes, as it were, in its characteristic onset. We have spoken of this in discussing the subject of functional nervous disorders, and may, therefore, proceed at once to describe its symptoms, just as we would the symptoms of a nerve-poisoning like morphin.

Symptoms.—The patient usually wakes up in the morning with a general sense of depression, which he well knows is a precursor of the onset of his old enemy. He has no appetite, and, in fact, during the acme of his attack the movements of the stomach are in abeyance. Soon the headache begins, usually on one side of the head, and hence the common name hemicrania. In different patients the onset is marked by various ocular disturbances, the commonest being scotoma,

or specks floating before the eyes. These may be dark, but often of brighter colors, persisting for an hour or more. Occasionally, illusions of geometric figures appear, to which the term "teicopsia" has been given, which means like the lines of a fortification; the headache increases in severity as the hours go on, while the patient becomes fully prostrated by it and is obliged to lie down. At this time it is not uncommon for sensations to radiate to different parts of the body, notably the arm. In time the wretched nausea develops, till it terminates in active vomiting, whence the term "sick headache." Usually, the vomiting relieves the patient of the headache, but sometimes the nausea persists for twenty-four hours. Although the attacks of migraine usually subside in one day, yet, where they frequently occur, the sense of general nervous prostration may last for more than twenty-four hours.

The attacks of migraine may recur only once a month, and in women particularly about the time of their menses, but in severe cases they may recur so often as to render life a burden. It is no contradiction to our previous contentions about this disease, that it is so often hereditary and very commonly a family complaint, because there is no such hereditary element in us as disorders of digestion. One other feature about migraine is that the patients outgrow it, as it is uncommon for it to continue to old age.

Treatment.—Being chiefly a digestive trouble, prophylaxis takes the leading part in the management of these cases, for whatever promotes digestion, by so much lessens the tendency to attacks.

First, therefore, as to prophylaxis. All severe cases, without exception, are chronic dyspeptics, and of this one of the commonest symptoms is chronic constipation. A mercurial laxative, such as a 5-gr. blue pill at night, with a saline in the morning to secure its action, is a weekly prescription of mine which I strongly insist upon in every case, to be kept up for months. I am sure that we do not possess a more certain intestinal antiseptic than a mercurial cathartic, and I never feel satisfied when a patient for any reason declines to persevere in its employment. As a further systematic measure for this purpose I prescribe from 1 to 2 drams of the sulphate of soda, with 10 gr. of sodium salicylate in a tumblerful of hot water, to be sipped down every morning on rising. With some, however, the sodium phosphate is preferred, though I do not think it is as effective as the sulphate. Then, one-half hour before each meal, a pill is prescribed of $\frac{1}{2}$ gr. of bichromate of potash, with 3 gr. of bismuth subcarbonate. Half an hour after meals and at night full doses of intestinal antiseptics, in the

form of 10 gr. of phenol bismuth or naphthol bismuth, with 10 gr. of ammonium benzoate or sodium benzoate, are given in two capsules.

While the benzoates are among our best intestinal antiseptics, yet our prescriptions of that nature ought to vary in different cases or at different times in the same case.

Thus, not uncommonly, the signs of intestinal derangement include diarrhea instead of constipation, and a brief recital from a case in my notes illustrates both how our prescriptions may be varied, and how extensively distributed may be the toxic nervous symptoms of a bad case of migraine:

Mrs. C., aged thirty-five years, came in June, 1899, for early morning diarrhea of four years' standing. She was frail looking, anemic, and emaciated. Has a great deal of nausea, and fears going about alone on account of "spells," when her jaw drops and she becomes unconscious, often for twenty minutes or half an hour, without any twitching, and when she recovers she feels as if her whole body had lost sensation, except the joints, which all seem to ache together. At other times she has strange feelings come on, with a tight sensation in the jaw, which drops, and she has then to sit down at once. She has cramps in the left muscles of the neck, in the right arm, and the left leg, with much nocturnal aching in all the extremities. With every one of these attacks she has flashes of rainbow colors, till she becomes quite blind; at other times she has for hours a scotoma before the right eye and and a distressing dizziness. Her attacks of unconsciousness come on about every three weeks, but the nausea and headaches occur between times so often that she rarely passes a well day. She was ordered to abstain altogether from red meats, to take a blue pill twice a week, a $\frac{1}{20}$ gr. pill of kal. bichromat. with bismuth before meals, with 2 drams of sodium phosphate and 10 gr. of sodium salicylate in hot water on rising, and an hour after meals 10 gr. each of phenol bismuth and sodium benzoate. In a few weeks she wrote that the last-named capsules made her nauseated. A prescription of

R. Salol..... 3ij;
 Bismuth subgallate..... 3j.—M.
 Ft. pulv. xxiv.

one-half hour before meals and at night was substituted, with a dessert-spoonful of pancreatic emulsion half an hour after meals for her diarrhea.

The note on August 23d was that she was improved in all respects, with subsidence of all her nervous symptoms. Had only one attack

of feeling nervous since last report, and has gained in weight and in color. The last note is February 27, 1900: Looks very well, has no headaches nor any of her old symptoms, but she likes to resort frequently to a prescription of October 15th, which was

R. Salicin..... 3ij;
 Ac. benzoici..... 3ss;
 Bismuth subcarb..... 3vss.—M.
 Ft. capsul. xlviii.
 Sig.—Two three times a day.

Now, this case might easily have been mistaken for epilepsy, but the accompanying symptoms were those of a migranous toxemia, and she recovered without taking any bromid. The blue pill, instead of increasing her diarrhea, seemed to check it, and she always felt better in her general state after it.

One aggravated patient referred to me from an inland city found, during last summer, her attacks much diminished, both in frequency and severity (they usually prostrated her for three days), and she gained 15 pounds in weight, but this September she had two sharp attacks. I changed from the phenol bismuth and benzoate to Dr. M. Allen Starr's prescription of—

R. Sodium sulphocarb..... gr. v;
 Cal. permangan..... gr. j;
 Betanaphthol..... gr. j.—M.
 Sig.—One after meals and at night,

the capsules being shellac covered to prevent their solution in the stomach. As she suffers from chronic constipation, she took—

R. Sodium sulphate..... 3j;
 Sodium phosphate..... 3iij;
 Sodium salicylate..... 3ij.—M.
 Ft. pulv. xii.
 Sig.—One in a tumblerful of water as hot as can be sipped on rising.

She took, besides, 15 gr. of the glycerophosphate of soda after meals. I have just received word from her that she feels much improved, and she still particularly praises the effect of the blue pill.

Prophylaxis is the main indication in the treatment of this complaint, but for the attacks themselves, when severe, the fluidextract of ergot, given in dram doses with a dram of elixir cinchona in water, by stomach or by rectum, is the most certain agent, in my experience, to cut the attack short. The patient should lie perfectly still after taking

it till all pain passes off, and in some cases the dose may be repeated after two or three hours.

In those who cannot take the ergot without vomiting I rely on 10 gr. of lactophenin, with 2 gr. of caffein citrate, repeated every two hours until relief occurs, or 15 gr. of antipyrin, always taken with a teaspoonful of aromatic spirits of ammonia.

Diet is a matter of great importance, because I believe that in every severe case the red meats should be abstained from altogether, or, at least, never taken at night. In other respects the digestive abilities and inabilities of each patient must be individually studied, as all experienced practitioners well know. Whatever is indigestible for any person is by that person to be avoided, but I find no general rule for this purpose except one, and that is, that if any article, either of food or of drink, is tasted again in an eructation from the stomach, that it does not want any more of that stuff, and that as a finality.

All nervous functional diseases have their exciting causes as well as their permanent causes. The exciting causes should never be confounded with the permanent causes, as they often are, as if all that we have to do is to prevent them and then the disease will cease. The commonest exciting cause of migraine is overtaxation of the nervous system, whether by thinking or by feeling, and likewise by undue exertion of the voluntary muscles. On this account migraine belongs to the worrying and restless periods of life, and then declines with the greater repose of old age. I have been struck in cases of persistence of migraine in elderly persons that it seems always connected with continuance of causes of mental anxiety and depression. It is in them that we have to fear the development of melancholia, and against that dread malady, in turn, I know of no better prophylactic than the measures for intestinal antisepsis which have been outlined for the treatment of migraine.

RAYNAUD'S DISEASE

This appears to be a purely vasomotor disorder, characterized by a local spasmodic contraction of the arterioles. It may be relatively a trivial disorder, and, in my experience, has occurred mostly in hysterical patients, who complain of two or three fingers of the hand looking and feeling dead. In time, however, usually in a few hours, a return to the opposite condition occurs, in which the fingers become both red and swollen. But Raynaud's disease may be a serious and even fatal complaint. Some of the worst cases are reported in children, when the local vasomotor spasm persists and shuts off the arterial circulation so long that actual gangrene takes place, preceded

in many cases by severe pains in the part. These cases, however, are quite rare, and their etiology is obscure. Many cases occur only in winter, following exposure to cold. It is in these patients that hemoglobinuria is apt to occur, as we have already explained in our remarks on that affection.

Treatment.—Raynaud's disease, when once established, may continue for years in its recurrence. During the attacks I would recommend the employment of nitroglycerin according to this prescription—nitroglycerin, $\frac{1}{2}$ gr.; water, 6 oz.; dose, from 1 to 2 teaspoonfuls every hour. When the attacks occur in the upper or lower extremities, Cushing recommends the employment of a tourniquet, applied so as to shut off the arterial circulation for a few minutes, and then removing the pressure, when an excess of arterial blood will follow. These measures should be repeated at least once in two hours, until the circulation returns to normal.

We may allude here, in this connection, to the not uncommon affection popularly known as chilblains, occurring usually as an erythematous condition of the skin about the feet and ankles; the heels are particularly apt to be involved, and lead to intolerable itching and burning of the parts. Being produced by cold, they are best treated by the application of hot lime-water liniment, to which oil of cinnamon, in the proportion of 1 dram to $\frac{1}{2}$ pint of the liniment, should be added.

ERYTHROMELALGIA

This rare affection, first described by Dr. Weir Mitchell, I have seen only once, in the person of an admiral of the American Navy. Its symptoms are a redness of the skin, usually of the feet, accompanied by severe general pains in the affected limb, which, however, differs from true neuritis in not being aggravated by pressure.

As a rule, the pains are mitigated by elevation of the limbs, and are aggravated by long standing or walking. Most cases, but not all, improve in winter and are worse in summer. Although one would suppose that all the signs of neuritis would be found, the only common alteration has been a generalized endarteritis in the affected parts.

I found, in the above-mentioned patient, the greatest relief was afforded by the coal-tar preparations of acetanilid and phenacetin.

CHAPTER XVII

ORGANIC NERVOUS DISEASES

LATERAL SCLEROSIS

THE most satisfactory account of this affection is by Erb, who fully described it in 1875.

Lateral sclerosis is very probably always a secondary degeneration in the spinal cord proceeding from a primary focus. The lesions that initiate this complaint may be in some cases demonstrated in the motor region of the brain cortex itself, and then be due to such diverse causes as brain tumor, abscess, or thrombosis, causing injuries, followed by demonstrable tracts of degeneration, both in the brain and in the spinal cord. Organic lesions anywhere in the brain in the course of pyramidal tracts in the cord will occasion this complaint. It is, therefore, not a disease, but a symptom following very diverse injuries.

Symptoms.—The chief symptoms are at first referred to the legs, often involving only one, but generally both legs, and consist at the beginning of great stiffness in movements of the muscles, making walking very slow and difficult. Tremors and muscular cramps are common. The knee reflex is much exaggerated. These conditions are plainly illustrated in the gait, which is shuffling. The patient cannot raise the toes, while the ankle clonus is increased, and the knees have a tendency to overlap, with great difficulty in abduction. Much fatigue is felt on walking. The whole leg becomes as stiff as if it were bound in a splint, and both knee and ankle movements are abolished. In time the stiffness of the legs leads to very serious contractures, so that the heels are pressed into the buttocks. Passive extension of the legs becomes impossible, from the resisting muscles feeling like hard cords. Ultimately, the tonic contraction of the muscles causes them to waste away, for nothing shuts off the circulation of the muscles like persistent cramp. The muscles of the hip, however, do not waste so constantly as those of the rest of the leg. There is no disturbance of the bladder or rectum and no sensory symptoms, except those produced by the cramps.

In the majority of cases the upper extremities are not involved, but when they are, the disease follows much the same course, beginning with the extensors of the fingers and wrists, conjoined with tremors.

That it may be impossible to discover a primary origin of this complaint obliges us to admit that there are cases of this disease beginning without any demonstrable lesions to which the affection is secondary. All authorities agree that there are cases apparently of true primary lateral sclerosis, but that should not lead us to omit a careful search in every case for some lesions to which the disease is secondary. Thus, I have found that cases with all the symptoms of this complaint could be ascribed to chronic pachymeningitis, and their contractures successfully treated, as hereafter will be detailed.

In all cases the disease is very chronic, and may at any time become stationary.

Treatment.—The treatment may be palliative, and consist, medicinally, of full doses of antipyrin, but, still better, of phenacetin; chloral and bromids may also be used. But for the painful cramps and startings of the limbs there is nothing so effective as the warm-water douche, which should always be practised for twenty minutes to half an hour before retiring.

DISSEMINATED SCLEROSIS

Disseminated or insular sclerosis is a very interesting organic disease of the nervous system because of the light which it throws on the physiology of an important element in the structure of the nerves of the cerebrospinal axis. The first step in the development of these nerves is the production of the axone, subsequently surrounded by a structure called the medullary sheath of Schwann. This sheath of Schwann contains an oily material which is wholly different in its origin and composition from those of the axone.

The sheath of Schwann is made up of tubes joined end to end, with a constriction at definite intervals, called the nodes of Ranvier. These constrictions in no way interrupt the course of the axone, but, when completed, the nerve is called medullated, and, on account of the composition of the oily substance, gives a white color to the nerves, which is absent in non-medullated nerves, such as those of the sympathetic system. There can be little doubt that the medullary sheath has for its purpose to insulate the axones from each other, analogous to, but by no means identical with, the insulation of an electric wire. The office of the myelin sheath is simply to prevent the nerve currents of adjacent axones from becoming confusedly mixed with each other. At no time, however, should a nerve current be confounded with an electric current, for, whereas a motor impulse in a nerve has been measured to traverse the nerve at the rate of about 140 feet per second, an electric current

can traverse a copper wire at the rate of 188,000 miles a second. But that the myelin sheath does answer a property of insulation analogous to an electric insulation is shown by this curious disease, disseminated sclerosis, for in this complaint all the axones appear as normal as ever, but the myelin substance has wholly disappeared. What causes this disappearance of myelin is unknown; the most probable explanation is that it is due to an unidentified toxin.

The clinical accompaniments, however, of disseminated sclerosis are just what we would imagine a loss of insulation of nerves between each other would produce. All the muscles of the body seem then to work independently, the gait becomes staggering, as if the man were drunk, and even the movements of the vocal chords become irregular, so that the voice changes to what is called "scanning," with a tendency to clip the sentence. Meantime, the movements of the lips and the muscles about the mouth become quite irregular, not unlike the efforts of speaking by persons in the early stages of paresis. The muscles that move the eyeballs also become affected, producing very pronounced nystagmus, more pronounced than in any other affection.

One of the clinical accompaniments of disseminated sclerosis is that of decided remissions, which may last for several months, inducing a deceptive promise of cure. The disease, however, is sure to return, and generally to involve parts which have before escaped.

As might be expected, the anatomic findings are almost universally limited to the white matter of the brain and spinal cord, and consist of plaques of irregular shapes and sizes. The sclerotic patches vary from a millimeter to several centimeters in diameter, and are of irregular shape. In a fresh state the patches are pinkish-gray and more translucent than normal brain tissue. Some have a gelatinous appearance. They replace the brain tissue without increasing its volume, hence are not like small tumors. But the chief feature is that, as the axones are not involved, no secondary degenerations occur, either leading from or to these patches. The lesions of disseminated sclerosis, therefore, differ altogether from any other sclerotic degenerations in nervous tracts.

Symptoms.—The clinical course of disseminated sclerosis is so varied in its accompanying symptoms that Buzzard is quite right in saying that no typical picture of multiple sclerosis can be drawn.

The patient has some numbness and weakness in the legs, which slowly increases, until he has a spastic, ataxic, or even cerebellar gait, and stiffness and paralysis in the legs, with increased knee-jerks,

ankle-clonus, and Babinski's sign. There is usually a slight difficulty in the control of the sphincters which appears early. The skin reflexes are often lost. The gait is usually like that of lateral sclerosis, the feet drawn along the floor and overlapping, and the legs stiff and adducted. The entire body sways in walking, which is due to an irregular contraction of the muscles of the trunk, producing what Oppenheim has termed "vascillation."

At the same time a tremor or, rather, a jerky, irregular action of the hands appears which is increased by effort, both to hold them still and to perform any fine motion. The rate of the tremor is from five to seven per second. This is termed by Germans the "intention tremor," for it subsides on ceasing to make effort.

The pupils are in the early stages contracted and then irregular, but always respond to light. Temporary attacks of blindness may occur, which are often followed by a permanent condition, due to optic atrophy; in fact, optic atrophy may be, as in tabes, the earliest symptom. It is a peculiarity of the defects of vision in multiple sclerosis that they vary from day to day, at times disappearing entirely. Vertigo is a common symptom.

Mental disturbances are also common, consisting of a loss of control, such as causeless laughing, which are frequently accompanied by a sense of general well-being, but not with the delusions of grandeur characteristic of paresis. The patient, instead, acts as if he were hysterical, often leading to difficulty of diagnosis from hysteria. Attacks of an epileptiform character occur, followed in some cases by hemiplegic and aphasic disturbances. Among the spinal symptoms loss of control of the sphincters may occur early, as above remarked.

As the disease progresses bulbar symptoms begin to develop, consisting of difficulty in deglutition, which are of serious import.

The duration of this disease is very uncertain, some reported cases dying within twenty months from the first symptoms, while others last for over twenty years. It is due to the spontaneous occurrence of decided remissions in the disease, which themselves are very difficult to account for, that the prognosis is so uncertain; but an early termination may be expected upon the supervention of the bulbar symptoms which we have described.

Treatment.—Nothing but general rules can be prescribed for treatment. Muscular exertion, whether general or local, should be avoided; in no other disease does the prolonged recourse to the rest cure seem so advantageous. Among medicinal remedies, cod-liver oil, conjoined with warm, but not hot, saline baths, in imitation of the Nauheim baths,

seem to be beneficial, but, as the disease is characterized by remarkable spontaneous remissions, the actual results due to treatment remain uncertain.

The disease is extremely uncommon in America, for, though I have seen cases in hospital practice and in my clinics, I have had only one patient with this complaint in private practice. In Europe, however, it seems to be much more common, especially in Germany.

AMYOTROPHIC LATERAL SCLEROSIS

This affection differs from chronic anterior poliomyelitis not only by its not being limited to the anterior horns of the spinal cord, but also by its involving the upper segment of the motor tract, reaching from the motor region in the cortex of the brain down to its distribution around the cells of the anterior horns of the spinal cord. In other words, it involves the whole motor tracts, from the cortex of the brain down to the feet.

Symptoms.—Its symptoms in general are, therefore, divided into two classes: the first being those of paralysis, beginning in the fingers and involving the muscles of the hand, forearm, and shoulder, which are simply paralyzed; and then the muscles of the legs, which present all the symptoms of spastic paralysis. In its course its symptoms develop irregularly, sometimes those of paralysis and atrophy in the arms, and then in the legs, resembling there the condition found in spastic paraplegia. Due to this irregular development in some cases the earlier symptoms are those of simple bulbar paralysis, but, as time elapses, the other symptoms, either in the arms or legs, show the true nature of the disease. If it begins in the arms, the signs are chiefly those of paralysis and atrophy of the fingers and hands, and then those of the upper extremities, until the arms hang helpless and cannot be raised. When all the symptoms are well developed in the upper extremities the arms are adducted to the body, the forearms are pronated, and the hands flexed or in the position of *main en griffe*. There is some resistance offered to passive movements, as the muscles are rigid and spastic even when quite weak.

When the disease begins in, or in time involves, the lower extremities, the symptoms are then closely similar to those of spastic paraplegia. The muscles are all rigid, the knee-jerks and ankle-clonus are exaggerated, the walking is difficult from the stiffness of the legs, the step being very short, with a scraping of the toes. There is no involvement, however, of the bladder or rectum, and no primary sensory symptoms, nor is there any localized anesthesia or paresthesia. The symptoms may

not begin in both legs at the same time, and in the early stage there is no fibrillary twitching. As in other similar disorders, the disease may seem to come to a standstill for a while, but no permanent improvement is to be expected. When the disease progresses the spastic rigidity of the muscles so increases that the patient has to take to his bed. After a time the spastic rigidity gives place to the same flaccid paralysis already present in the arms. In the neck the paralysis may in time involve the muscles which support the head, so that it falls forward.

One of the characteristic symptoms of the disease is the great increase in the muscular irritability in all the muscles that are affected. Percussion, either on the muscle or on its tendon, causes a quick, unusually sharp contraction, and this exaggeration of reflex activity throughout the entire body, both in the muscles that are atrophic and in those that are spastic, is characteristic of the disease, and is not present in progressive muscular atrophy. This is particularly well illustrated in the muscles of mastication, which, when tapped, produce a prompt closing of the jaw. The disease may, in its progress, involve the muscles of the back, so that the patient can no longer sit up in bed. Rapid action of the heart may then set in, and is a grave symptom, often preceding death.

Meanwhile the psychical functions of the brain remain undisturbed, consciousness and memory being unaffected, the only change being emotional, so that the patient may laugh or cry from weakness of self-control.

The duration of the disease depends upon the parts first affected. If bulbar symptoms set in early, the case is not apt to last beyond two years. If, however, the symptoms are chiefly those of lateral sclerosis, the patient may live for a number of years. Aggravation of the bulbar symptoms usually carry off the patient by intercurrent pneumonia, but speedy death often follows the development of tachycardia, soon succeeded by heart failure.

Treatment.—We have no remedies of much avail in the treatment of this affection other than those general nutritive agents which we have already spoken of in the treatment of chronic anterior poliomyelitis.

ACUTE ANTERIOR POLIOMYELITIS

This affection occurs in two quite distinct forms, the first of which is the sporadic, which has been known for a very long time; the second, and a very different affection, is that which occurs epidemically, and whose medical history is much more recent. The incidence of both forms are almost limited in their occurrence to children.

Sporadic poliomyelitis and epidemic poliomyelitis are two distinct affections, differing both in their cause and in their nature. *Sporadic poliomyelitis* is plainly as accidental an affection as a broken leg. A child, when heated in play, sits on a cold door-step, or lies down on cold ground, and that night wakes up with a backache, which is commonly associated with slight fever, usually not rising above 102° F. In the morning it is found unable to move its legs. After a few days one of its disabled legs recovers gradually but completely, but not so the other, certain groups of its muscles remaining paralyzed, and then undergoing an atrophy which lasts for life. The point, however, which we would here emphasize is, that none of this child's young brothers or sisters, nor any of its companions, catch this disability from it, because it is no more communicable than a sprained ankle or a dislocated shoulder. There is no case on record of this long, well-known form of sporadic poliomyelitis spreading from one person to another and thus becoming epidemic.

But there is a poliomyelitis which is *epidemic*. This fact of itself should call for investigation, to find whether this form does not show characters which wholly separate it from our old familiar sporadic form. Affections like inflammations of joints, which have certain features in common, are often confounded together, such as rheumatism and gout. But neither rheumatism nor gout differ so essentially from one another, as on investigation we find to be the case between sporadic and epidemic poliomyelitis. This difference is clearly illustrated by the findings of pathologic anatomy. In the sporadic form only the anterior horns, with their motor fibers, are changed, the affection being strictly limited to parts of the spinal cord supplied by a branch of the anterior spinal artery.

This artery is very long, virtually commencing at the foramen magnum, and continuing all the way down in its groove on the anterior surface of the spinal cord, until it terminates in branches supplying the cauda equina in the sacrum.

There is first in the sporadic form an active congestion of the spinal meninges and of the gray matter of the spinal cord supplied by the branches of the anterior spinal artery. From the anterior spinal artery about one hundred branches are given off, which enter the cord horizontally at various segments, supplying the anterior cornua without anastomoses. Many groups of cells extend more than $\frac{1}{2}$ inch, and hence are supplied by more than one branch of this artery. The blood-vessels are distended and some of the capillaries are ruptured, allowing extravasations of blood-cells; the perivascular spaces and the

gray matter of the cord are filled with emigrating leukocytes, and there is a considerable exudation of serum. The serum fills the lymph-spaces about the vessels and about the nerve-cells; the leukocytes infiltrate the tissues everywhere, cluster about the cells, and make their way into the cells. This destruction of the cells by leukocytes has been termed "neuronophagia." There is also a great increase of small cells and nuclei throughout the neuroglia, which may be due to a proliferation of the neuroglia cells or of the endothelial elements, or may be due to an emigration from the blood-vessels. This infiltration of the tissues with leukocytes and nuclei may be so intense as to obscure all other elements. It is thus evident that the blood-vessels and the neuroglia, as well as the ganglion cells in the gray matter of the cord, share in the pathologic process.

The anatomic changes which occur in a sporadic form in the cells of the anterior horns are very definite and characteristic. They are characteristic because their location never varies, being limited to the motor anterior horns of the spinal cord, and consist essentially of a thorough disorganization of the cell implicated, as we have described. This, however, is complete only in those patients in which a permanent and not transitory paralysis and atrophy of certain groups of muscles persist; in the leg, for example, which is affected, beginning in the earlier stages with acute congestion and inflammation of the cells, which, however, varies in different cases, so that in some the disorganization is but moderate and admits of recovery.

But in epidemic poliomyelitis the changes, instead of being limited, involve, according to Flexner, the spinal cord, intervertebral ganglia, medulla, pons, cerebellum, and meninges, with injury to the white matter of both the spinal cord and brain. Moreover, it induces serious changes in the whole lymphoid tissue of the body, including the agminated glands of the intestine. Besides these there occur visceral lesions in the lungs and in the liver.

These facts readily explain another significant contrast between the two affections. Sporadic poliomyelitis but rarely causes death or even much constitutional disturbance, all on account of its limited extent. It does not invade the posterior horns nor cause transverse myelitis, nor ascending or descending cord changes. The patients subsequently enjoy perfect health, with the exception of localized paralysis. Epidemic poliomyelitis, on the other hand, is a fatal disease, the death-rate varying from 6 to 10 per cent. in different epidemics or localities. In epidemic poliomyelitis, notwithstanding the widespread derangements which it occasions, the disease usually passes

on in a remarkably short time to complete recovery in most patients. This is another striking contrast, for the disabling results of sporadic poliomyelitis are both invariable and life-long in their duration.

We would, therefore, emphasize anew the great and contrasting anatomic changes which epidemic poliomyelitis causes, so as to show that these two affections no more resemble one another than small-pox resembles urticaria. Epidemic poliomyelitis, unlike sporadic poliomyelitis, causes enlargement of the mesenteric glands and enlargement of the spleen, thymus, tonsils, and superficial and deep glands of the neck and focal necroses of the liver cells, besides all those widespread changes already mentioned in the substance of the cord and brain. Hence it presents all the characters of a virulent infection, and, therefore, can and does become epidemic. Also that instances of it can occur *de novo* or sporadically is no more likely than in the case of typhoid fever.

Now, as we have said, these two affections differ altogether in their etiology and pathology. We have already discussed the mechanism of that frequent cause of disease and of death, commonly termed "catching cold" ("Medical Record," Feb. 17, 1912, p. 301). Catching cold is caused by some localized shutting off of arterial blood from the part. This occurs whenever a local chill affects a part of the surface of the body which has vasomotor associations with internal parts or organs. The vasomotor nerves ramify on the coats of the arteries so as to control their caliber, either contracting or dilating same, according to the functional needs of the part. Among other laws of vasomotor association which we cited is the intimate association between the vasomotor nerves of the skin and the circulation of parts underneath that cutaneous area. No cells of any texture, such as those of the mucous membranes, can suffer any withdrawal, however brief, of any arterial blood without injury. But this is particularly the case with the nerve-cells, for these at once are disorganized by the shutting off of their arterial supply. Hence, if a child has a local chill on any part of the skin over the spinal cord, it is then very liable to suffer from the changes in its arterial circulation, which, in this case, are limited to the branches of the anterior spinal artery.

In both diseases, we have children affected much oftener than older patients. This may be explained by the vulnerability in children of the spinal cord to injuries, especially as the pyramidal tracts are so late in their development and thus more liable to derangement. In the sporadic form the growth of the leg may be so affected as to become shorter than the other, and from the first its vasomotor nerves are so

involved that the limb becomes cold. As time goes on the atrophied muscles produce not only lameness, but also deformity of the joints, which have to be specially treated so as to compensate for this disability. Such particular and localized changes do not occur in the epidemic form.

The incidence of the epidemic form is striking according to the season of the year—namely, during the summer months—while the sporadic form commonly occurs during cold weather. The epidemic form has occurred in Europe in scattered localities—in France, Italy, Germany, and Denmark, more especially in Sweden. In the United States it has been very prevalent, occurring in the majority of the States of the Union. There can be no question that the epidemic form is of the nature of an infection, and, therefore, the question of its communicability is of great importance; that is, whether it may be directly communicated, so that it may be properly termed “contagious,” or indirectly, as in typhoid fever, by some intermediate carrier. Such a question cannot well be determined in crowded cities, hence the importance of a careful study of the epidemics in purely rural communities. Thus, I was called in consultation to see a boy living in an agricultural neighborhood in Dutchess County, New York. He was then paralyzed in both legs, and had considerable difficulty in micturition, which never occurs in the sporadic form. I learned that the boy who sat next to him on a bench in a schoolhouse had been taken with the disease eight days previously and died from it in four days. I was then taken three miles to a house in which a young woman was comatose, with all the symptoms of cerebrospinal meningitis, from which she died. I then learned that the boy whom I first saw was a cousin of hers, and that he slept in her house for two nights five days previous to the first symptoms which she developed. So far as these cases went, therefore, they would indicate that the disease was communicated directly from one patient to another. I urged the physicians who called me in consultation to ask for a committee of their county medical society to investigate the succession of cases in a district of about twelve square miles, where people were very likely to be acquainted with one another, impressing upon them the importance of such observations being made there, compared with any observations in large towns or cities; but, though I offered to present their reports before the New York Academy of Medicine, of which I was then president, I heard nothing more on the subject.

In the widespread epidemic of poliomyelitis in the city of New York three years ago the symptoms of the disease were often scarcely dis-

tinguishable from those of cerebrospinal meningitis, a fact not surprising, considering how often epidemic poliomyelitis begins in the blood-vessels of the meninges. Epidemic poliomyelitis, when it occurs in rural communities, is plainly a communicable disease, and hence the profession should take steps to have it thoroughly investigated by competent observers whenever an isolated epidemic is reported. In large cities, on the other hand, it is often impossible to settle how any infectious disease is propagated, whether it be measles, diphtheria, whooping-cough, or the rest. The one practical conclusion is that, if any infection is suspected to be directly communicable, the only measure then to deal with it should be by isolation or quarantine.

Though uncommon in the sporadic form, cases have been reported in which the arm and shoulder are involved. If in the arm, the muscles of the forearm, including those of the wrist and fingers, are affected in groups. The extensors and flexors of the fingers and the wrists, with the supinator longus, may be affected, due most probably to the proximity in the cord of the centers of muscles which are functionally associated together.

Treatment.—As the onset of sporadic poliomyelitis is usually sudden the child retires to bed apparently in its normal state of health, but wakes in the morning with its legs paralyzed, and is, unfortunately, not amenable to treatment at this stage. Local applications of counterirritants to the spine are quite useless. If the child complains of much pain, phenacetin may be used every four hours in 5-gr. doses, otherwise nothing can be done but to keep the child quiet in bed for a week. After this a careful examination as to the responses of individual muscles to electric excitations should be begun, to find if any of the muscles respond readily to the interrupted Faradic current. The prognosis is good, but not so where the so-called reaction of degeneration occurs, for in this there is loss of all reaction in the Faradic current, and, instead, a slow imperfect reaction to the galvanic current, noticeable on the application of the anode, but not of the cathode, and finally even this reaction is lost. Soon it is found that the affected muscles are not only paralyzed, but rapidly atrophy, a change which also occurs in the bones, leading to shortening of the limb, compared with its fellow; but as these changes are limited after a while to only certain groups of muscles, while others remain intact, the tendency in time results in deformity of the joints, due to the unequal pull on them of the non-paralyzed and the paralyzed muscles. These deformities in time can only be treated by a specially adjusted apparatus. Meanwhile, in the early stages, careful inspection may show that some

muscles, especially those which react to the Faradic stimulus, are capable of much improvement in their functions by massage. This should be performed with the help of the hand, lubricated with coconut or olive oil, the massage being at first only once a day, for twenty minutes at a time, but afterward twice a day, night and morning. Electricity, however, is of little value in confirmed cases, and all measures should be adopted to improve the general nutrition and the child kept as much as possible in the open air.

In the epidemic form, as might be expected with any serious infection, we have no real, efficacious remedies, and must trust to nature. While severe cases end in death in from 6 to 10 per cent. of all patients, complete recoveries, without any of the resulting local paralysis characterizing the sporadic form, may be expected. In fact, it is remarkable how, notwithstanding the extensive textural changes which characterize the epidemic form, the ultimate recovery from them all is often striking.

During the acute onset the patients often complain of severe pains, such as those which occur in cerebrospinal meningitis, and, like them, may respond favorably to free doses of the fluidextract of ergot, combined with 5- to 10-gr. doses of phenacetin.

For further illustration in the contrasts between these two affections we subjoin the following table:

SPORADIC.	EPIDEMIC.
Never infectious or epidemic.	Always due to an infectious filterable virus which can become epidemic.
Due to a cold affecting some branches of the anterior spinal artery.	Always due to an infection.
Usually beginning with febrile symptoms like any other cold.	Usually but not always beginning with febrile symptoms.
Complete recovery rare, particular groups of muscles remaining paralyzed.	Usually complete recovery, localized paralysis uncommon.
Not fatal.	Fatal in from 6 to 10 per cent.
No more prospect of antisera than there can be a sera for a broken leg.	Antisera probable as in other infections.

CHRONIC ANTERIOR POLIOMYELITIS

Chronic Atrophic Paralysis. Progressive Muscular Atrophy

This disease has been long recognized as characterized by paralysis and atrophy of the skeletal muscles of a progressive form, usually beginning in the lower extremities, and identified by Aran as connected with the degeneration of the anterior horns of the spinal cord, similar to that which we have been reviewing in the acute paralysis among children. The only differences are its more chronic course, the

cells of the anterior horn being found disorganized in the same fashion as they are in the anterior poliomyelitis of children, and that it occurs among adults, being a progressive disease, advancing upward to the trunk, until it finally involves the cells that supply the muscles of respiration, and thus causes death.

But between 1860 and 1870 numerous cases of atrophic paralysis were reported in which no spinal lesion was to be found, and hence it became evident that some forms of this disease were dependent not on spinal lesions, but on primary affections of the muscles.

To Friedreich and the German school must be given the credit of separating the muscular dystrophies from the forms of true spinal paralysis.

In 1872 Charcot and the French school discovered amyotrophic lateral sclerosis, and showed the difference between it and progressive muscular atrophy. In time Dejerine and other French authors showed that many cases, formerly supposed to be due to spinal disease, were really cases of multiple neuritis.

In chronic anterior poliomyelitis this disease consists of a slowly advancing atrophy in the primary motor neurones of the cord, cell bodies, dendrites, and axones degenerating together. This disease causes symptoms according to the part of the spinal cord which is attacked; thus, in one form the atrophy begins in the lower groups of cells of the lumbosacral region and extends to all the groups in the lumbar enlargement, but in all cases of muscular atrophy from spinal disease the affected muscles for a long time after the beginning of the disorder present fibrillary contractions recognizable under the skin. These slight twitchings do not affect the whole muscle, but are present only in limited strands, and can be caused either by exposure to cold or by tapping the muscle itself. The paralysis begins in the peronei and anterior tibial groups of muscles, then advances to the adductors of the thigh and glutei, and finally invades all the muscles of the legs, but does not extend to the arms.

In the next form the disease slowly progresses upward until the cells of the anterior horns are found degenerated quite up to the cervical enlargement. As it thus progresses, the cells supplying the muscles of respiration are involved, with a result of causing death by implication of the apparatus of breathing. Commonly, however, the patient succumbs to intercurrent affections, such as pneumonia, before the spinal degenerations are complete.

In some cases the disease seems to be limited first to the cervical regions, before the cells of the lumbar enlargement are involved. When

this occurs the muscles of the shoulder, such as the deltoid and brachialis anticus, are affected. The arm then hangs helpless and cannot be raised. It is significant, however, that, whether the paralysis involves the legs or the arms, yet in none of these anatomic changes in the spinal cord are its membranes affected, the changes noted being evident only on microscopic examination as those of simple degeneration of the cells and of their axones and dendrites, without a sign of any inflammatory process, from which we would infer that the whole process is of toxic origin and nature, extending to all the groups of association fibers.

The symptoms of this disease, when it affects the legs, usually begin in one leg, and then after two or three months extend to the other leg.

Treatment.—On account of our ignorance of the causes in the wasting of spinal tracts which characterize this disease we have no means of successfully treating it, and can only proceed according to general principles. Cases occur in which apparent spontaneous arrest in the progress of the complaint occurs, but these are usually temporary. Hypodermic use of strychnin in $\frac{1}{60}$ -gr. doses has been employed, but, in my opinion, is useless, except as a possible adjuvant to those more promising agents for improving the general nutrition, such as cod-liver oil and intermittent use of arsenic. The affected muscles should not be exercised, because in them fatigue is quickly induced, and after fatigue the disease progresses more rapidly, but the patient should be allowed to take the open air as much as possible in a rolling chair. Massage of the muscles with olive oil may be tried once or twice a day, but even this passive exercise should not last more than twenty minutes at a time.

BULBAR PARALYSIS

By bulbar paralysis is meant a disease which involves the motor nuclei found in the floor of the fourth ventricle. It occurs commonly as a complication in the progress of chronic wasting affections of the spinal cord, such as in amyotrophic spinal paralysis, which we have already described. Occasionally it assumes an acute form, due to hemorrhage or occlusion of the arteries supplying the centers in the floor of the fourth ventricle. When its symptoms develop rapidly, as a result of the necrosis of the parts in the floor of the fourth ventricle, the first signs are paralysis of the lips, which remain open, with drooling of the saliva; along with this is paralysis of the tongue, which becomes atrophied and shows fibrillary twitchings. The more serious symptoms, however, are those of paralysis of deglutition, which, conjoined with paralysis of the vocal chords, renders both phonation and

speaking indistinct, these affections all contributing to fits of choking from particles of food entering the larynx, and thus inducing fatal pneumonia.

SYRINGOMYELIA

The central canal of the spinal cord possesses a peculiar interest because it consists virtually of the remains of the earliest structure which appears in the development of the spinal cord itself, being a canal around which all the structures of both the gray and white matter of the cord subsequently develop. When this occurs this canal would seem as if it were obliterated, which is never the case, but remains through life as a minute canal, extending through the whole length of the spinal cord from the fourth ventricle down to the conus medullaris in the sacrum. On account of its origin it is lined by a peculiar gliomatous layer of cells, which belong plainly to primitive embryonal tissues.

In the disease called syringomyelia this central canal becomes dilated in a very irregular fashion with fluid accumulating in it, which leads to numerous secondary changes, sometimes of the nature of diverticula themselves, occasionally the diverticula being so long as to obscure the course of the central canal itself. But the original gliomatous structure still remains, so that authors speak of the disease as a gliosis of the spinal cord. A great many theories have been advanced as to the origin and cause of this disease, but the most probable one is that it is due to a congenital defect in the development of the spinal cord, dilatations occurring along the course of the central canal, which may be very irregular in their location and in their extent. When the fluid is let out in such cases the cord seems to be shrunken in parts. Occasionally these accumulations have been so great that but a thin wall of normal cord tissue remains. The common site is in the cervical regions, and especially involving the posterior structures of the cord, but cases occur in which the extent may be nearly that of the whole length of the cord. As might be easily inferred, the symptoms of this affection are very numerous and complex, so that but for the great peculiarity of disorders of sensation in the parts involved the diagnosis might be very difficult, but that peculiarity is significant enough to make the nature of the complaint quite plain. It consists in a dissociation of the three senses—of touch, of pain, and of the appreciation of heat and of cold, or the thermic sense. Thus, the sense of touch in the affected part may be preserved, while the sense of pain is lost, and with it the thermic sense, the patient being unable to distinguish between the application of a test-tube filled with hot water or ice-water.

Meanwhile the results of internal pressure on the different spinal tracts may produce both paralysis and spasm characteristic of amyotrophic paralysis. If the pressure is mainly on the posterior column the symptoms may resemble those of tabes, but, in any case, the separate dissociation of the sense of touch from that of pain or of heat and cold will settle the diagnosis.

This disease reveals to us what some of the paths in the spinal cord of sensation are. Thus, the upward paths of the sensation of pain and of temperature differ in their location from the sense of touch, for they pass into the central portion of the gray matter of the spinal cord soon after their entrance.

"It is certain that their entire course, from below upward, is not in the gray matter; otherwise a limited lesion of this portion in the cervical segments would produce a disturbance of these senses in the entire body below the lesion; but it appears that these sensations, on their way from the surface of the body to the centripetal white columns of the cord (the anterolateral tracts), traverse the gray matter at the level at which they enter; hence the distribution of this disturbance of sensibility corresponds exactly to the position of the lesion in the spinal cord" (Starr). As the various segmental cutaneous areas of sensation have been independently determined, it is possible in syringomyelia to settle the precise location of the lesions in the spinal cord. Thus, as commonly is the case, syringomyelia begins in the cervical portion of the cord, and the patients are first made aware of their trouble by their fingers being no longer sensitive to pain, so that, as pain is the great preservative against injury, these patients suffer various injuries to their fingers without knowing it. When the disease is fully established the patient cannot distinguish between the application of boiling water or ice water, and his fingers may be cut into without his knowing it; on that account the site of an injury may become seriously infected by micro-organisms without the patient knowing why. But disturbances in the nutritional part also occur in syringomyelia without it being possible to assign them to the above-mentioned causes; on that account this disease has been supposed to demonstrate the separate existence of a class of nerves called trophic nerves, whose function is to preside over nutrition, especially nutrition of the skin. "The skin is the seat of the chief trophic disturbances. These may be of various kinds. There may be localized hyperemia or anemia of the skin. There may be changes in the perspiration, the part being abnormally covered with sweat or abnormally dry, and, in addition to the acute inflammation of the skin already mentioned as produced by injuries,

cases have been observed of serous exudation with desquamation, gangrene of the skin and subcutaneous tissue, bullæ, and peculiar hypertrophies and atrophies of the skin" (Starr). It should be noted, however, that these cutaneous affections are not symmetric; that is, they do not occur in just the same form on both sides of the body.

Morvan has described a disease occurring in a seaport of France among fishermen, consisting of felons appearing upon the fingers, producing deep ulcerations and even necrosis of the terminal phalanges. These were associated with other trophic disturbances of the skin and nails and with analgesia. This so-called Morvan's disease is now considered as a variety of syringomyelia, because in all cases examined after death a cavity has been found in the spinal cord. The nails also become quite distorted, being thickened or irregular in form and very brittle.

Affections of the joints and bones are frequently observed in syringomyelia. In fact, there is no nervous disease in which joint affection occurs so commonly as a complication; the shoulder, elbow, and wrist are the joints most frequently affected. Affections of the bones and joints are common in syringomyelia, but, in distinction from tabes, they occur more often in the upper extremities and in the legs. These affections, however, resemble those in tabes by their consisting first of large effusions within the joints, which are then absorbed, leaving great thickening of the tissues, with absorption of the bony structure of the joint, producing disorganization of the articulation.

Nor do the long bones escape, for irregular development of the bony tissues occurs, with absorption in parts, until the bones may spontaneously fracture; in other words, all processes of healing are disturbed in this strange affection. As these fractures occur without pain, they may at first be neglected by the patient until revealed to him by their consequent disability. As might be expected, the spinal column may not escape, and various deformities of the spine may thus occur.

Accompanying the disease also of the bones and joints they necessarily develop various muscular atrophies, with such disablement of movement that the case may resemble those affections which we have described characteristic of chronic anterior poliomyelitis or amyotrophic spinal paralysis. From this affection, however, they may be distinguished, on careful examination, by the pathognomonic local dissociation of the tactile sense from the sense of pain and the thermic sense.

The progress of the disease is very slow, but as certain instances show that the whole spinal cord becomes involved, the consequent

symptoms may resemble either one of several of the different affections of the cord which we have described, such as the formation of bed-sores, loss of control over the sphincters, etc.

Treatment.—The prognosis of the complaint is necessarily unfavorable, as we have no effective means of treating it, and we can deal only, and that imperfectly, with its concomitant symptoms.

It is not uncommon, however, for the disease to come to a standstill, though we cannot explain why, and meantime our chief efforts should be to maintain the general nutrition of the patient as much as possible.

BRACHIAL PLEXUS

Affections of the branches of the brachial plexus will present us with symptoms implicating the position and the movements of the muscles of the shoulder and of the arm which can be diagnosed only according to the physician's knowledge of the distribution of both the motor and sensory nerves implicated.

First, there may be an anomaly in the presence of a cervical rib, and this is always a cause of annoyance, which, in the majority of cases, can be remedied only by excision of the rib. The commonest causes, however, of brachial neuritis are of traumatic origin, such as dislocation of the head of the humerus into the axilla, or from falls or blows on the part involved.

Affections of the nerves are more frequent and important. Pain is common, corresponding, as a rule, to the distribution of the eighth cervical and first dorsal roots, extending along the ulnar border of the forearm to the wrist or fingers. In other cases there is marked pressure on the brachial plexus, with partial paralysis and wasting of the intrinsic muscles of the hand. There may be anesthesia or hyperesthesia of the inner aspect of the arm and the ulnar half of the hand. In a few instances there has been pressure on the cervical sympathetic nerve.

The condition is, as a rule, readily recognized, sometimes by palpation, always with the *x*-ray picture.

Combined Paralysis.—The plexus may be involved in the supra-clavicular region by compression of the nerve trunks as they leave the spine, or by tumors and other morbid processes in the neck. Below, the clavicle lesions are more common, and result from injuries following dislocation or fracture, sometimes from neuritis. A cervical rib may lead to a pressure paralysis of the lower cord of the plexus. A not infrequent form of injury in this region follows falls or blows on the neck, which, by lateral flexion of the head and depression of the shoul-

der, seriously stretches the plexus. The entire plexus may be ruptured and the arm be totally paralyzed. The rupture may occur anywhere between the vertebræ and the clavicle, and involve all the cords of the plexus or only the upper ones. The so-called "obstetric palsy," due to drawing apart of the head and the shoulder during delivery, is an instance of this sort of injury. In these cases, however, the rupture of the plexus is usually only a partial one, involving its upper cord alone, so that the deltoid, biceps, supra- and infraspinatus, brachialis anticus, and supinator longus muscles may alone be affected. When the entire plexus has been ruptured, a complete motor and sensory paralysis of the arm is produced. The roots may even be torn away from the spinal cord. The pupil will then be contracted on the side of the injury and the arm hang from the body like a flail. Another common cause of lesion of the brachial plexus is luxation of the head of the humerus, particularly the subcoracoid form.

A primary neuritis of the brachial plexus is rare. More commonly the process is an ascending neuritis from a lesion of a peripheral branch, involving first the radial or ulnar nerves, and spreading upward to the plexus, producing gradually complete loss of power in the arm.

LESIONS OF INDIVIDUAL NERVES OF THE PLEXUS

(a) **Long Thoracic Nerve.**—*Serratus paralysis* follows injury to this nerve in the neck, usually by direct pressure in carrying loads, and is very common in soldiers. It may be due to a neuritis following an acute infection or exposure. Isolated serratus paralysis is rare. It usually occurs in connection with paralysis of other muscles of the shoulder-girdle, as in the myopathies and in progressive muscular atrophy. Concomitant trapezius paralysis is the most frequent. In the isolated paralysis there is little or no deformity, with the hands hanging by the sides. There are slight abnormal obliquity of the posterior border of the scapula and prominence of the inferior angle, but when, as so commonly happens, the middle part of the trapezius is also paralyzed, the deformity is marked. The shoulder is at a lower level; the superior angle projects upward. When the arms are held out in front at right angles to the body the scapula becomes winged and stands out prominently. The arm cannot, as a rule, be raised above the horizontal. The outlook of the cases, due to injury or to neuritis, is good.

(b) **Circumflex Nerve.**—This supplies the deltoid and the teres minor. The nerve is apt to be involved in injuries, in dislocations, bruising by a crutch, or sometimes by extension of inflammation from

the joint. Occasionally the paralysis arises from a pressure neuritis during an illness. As a consequence of loss of power in the deltoid, the arm cannot be raised. The wasting is usually marked, and changes the shape of the shoulder. Sensation may also be impaired in the skin over the muscle. The joint may be relaxed, and there may be a distinct space between the head of the humerus and the acromion.

(c) **Musculospiral Paralysis; Radial Paralysis.**—This is one of the most common of peripheral palsies, and results from the exposed position of the musculospiral nerve. It is often bruised in the use of the crutch, by injuries of the arm, blows, or fractures. It is frequently injured when a person falls asleep with the arm over the back of a chair, or by pressure of the body upon the arm when a person is sleeping on a bench or on the ground. It may be paralyzed by sudden violent contraction of the triceps. It is sometimes involved in a neuritis from cold, but this is uncommon in comparison with other causes. The paralysis of lead-poisoning is the result of involvement of certain branches of this nerve.

A lesion when high up involves the triceps, the brachialis anticus, and the supinator longus, as well as the extensors of the wrist and fingers. Naturally, in lesions just above the elbow the arm muscles and the supinator longus are spared. The most characteristic feature of the paralysis is the wrist-drop and the inability to extend the first phalanges of the fingers and thumb. In the pressure palsies the supinators are usually involved, and the movements of supination cannot be accomplished. The sensations may be impaired, or there may be marked tingling, but the loss of sensation is rarely so pronounced as that of motion.

The affection is readily recognized, but it is sometimes difficult to say upon what it depends. The sleep and pressure palsies are, as a rule, unilateral, and involve the supinator longus. The paralysis from lead is bilateral and the supinators are unaffected. Bilateral wrist-drop is a very common symptom in many forms of multiple neuritis, particularly the alcoholic; but the mode of onset and the involvement of the legs and arms are features which make the diagnosis easy. The duration and course of the musculospiral paralyses are variable. The pressure palsies may disappear in a few days. Recovery is the rule, even when the affection lasts for many weeks. The electric examination is of importance in the prognosis, and the rules laid down under paralysis of the facial nerve hold good here.

The *treatment* is that of neuritis.

(d) **Ulnar Nerve.**—The motor branches supply the ulnar half of the deep flexors of the fingers, the muscles of the little finger, the inter-

ossei, the adductor and the inner head of the short flexor of the thumb, and the ulnar flexor of the wrist. The sensory branches supply the ulnar side of the hand—two and one-half fingers on the back, and one and one-half fingers on the front. Paralysis may result from pressure, usually at the elbow-joint, although the nerve is here protected. Possibly the neuritis in the ulnar nerve in some cases of acute illness may be due to this cause. Gowers mentions the case of a lady who twice had ulnar neuritis after confinement. Owing to paralysis of the ulnar flexor of the wrist, the hand moves toward the radial side; adduction of the thumb is impossible; the first phalanges cannot be flexed, and the others cannot be extended. In long-standing cases the first phalanges are overextended and the others strongly flexed, producing the claw-hand; but this is not so marked as in the progressive muscular atrophy. The loss of sensation corresponds to the sensory distribution just mentioned.

(e) **Median Nerve.**—This supplies the flexors of the fingers, except the ulnar half of the deep flexors, the abductor and the flexors of the thumb, the two radial lumbricales, the pronators, and the radial flexor of the wrist. The sensory fibers supply the radial side of the palm and the front of the thumb, the first two fingers and one-half of the third finger, and the dorsal surfaces of the same three fingers.

“This nerve is seldom involved alone. Paralysis results from injury and occasionally from neuritis. The signs are inability to pronate the forearm beyond the mid-position. The wrist can be flexed only toward the ulnar side; the thumb cannot be opposed to the tips of the fingers. The second phalanges cannot be flexed on the first; the distal phalanges of the first and second fingers cannot be flexed; but in the third and fourth fingers this action can be performed by the ulnar half of the flexor profundus. The loss of sensation is in the region corresponding to the sensory distribution already mentioned. The wasting of the thumb muscles, which is usually marked in this paralysis, gives to it a characteristic appearance” (Osler).

Treatment.—The only treatment which I have found efficacious in these distressing cases has been the introduction of the arm into the hot-air box, as described in our article on Sciatica. Even in cases of traumatic origin it has been efficacious when every other measure had failed.

LUMBAR PLEXUS

“**Lumbar Plexus.**—The lumbar plexus is sometimes involved in growths of the lymph-glands, in psoas abscess, and in disease of the bones of the vertebræ. When paralyzed the *obturator nerve* is occa-

sionally injured during parturition. When paralyzed the power is lost over the abductors of the thigh, and one leg cannot be crossed over the other. Outward rotation is also disturbed. The anterior crural nerve is sometimes involved in wounds or in dislocation of the hip-joint, less commonly during parturition, and sometimes by disease of the bones and in psoas abscess. The special symptoms of affection of this nerve are paralysis of the extensors of the knee with wasting of the muscles, anesthesia of the anterolateral parts of the thigh, and of the inner side of the leg to the big toe. This nerve is sometimes involved early in growths about the spine, and there may be pain in its area of distribution. Loss of the power of abducting the thigh results from paralysis of the gluteal nerve, which is distributed to the gluteus medius and minimus muscles.

“External Cutaneous Nerve.—A peculiar form of sensory disturbance, confined to the territory of this nerve, was first described by Bernhardt in 1895, and a few months later by Roth, who gave it the name of *meralgia paræsthetica*. The disease is probably due to a neuritis which seems to originate in that part of the nerve where it passes under Poupart’s ligament, just internal to the anterior superior iliac spine. The nerve is usually tender on pressure at this point. The disease is more common in men. Musser and Sailer in 1900 collected 99 cases, of which 75 were in men. A large number of the cases are attributable to direct traumatism or to simple pressure on the nerve by the aponeurotic canal through which it passes. Pregnancy is among the more common causes in women. The sensory disturbances consist of various forms of paresthesia located over the outer side of the thigh, oftentimes with some actual diminution in the acuity of sense perception. The symptoms, in varying intensity, may persist for years, and the discomfort in some cases be so great and so much exaggerated even by the mere touch of the clothing that patients may be greatly incapacitated thereby. Excision of the nerve as it passes under Poupart’s ligament has given good results.

“Sacral Plexus.—The sacral plexus is frequently involved in tumors and inflammations within the pelvis and may be injured during parturition. Neuritis is common, usually an extension from the sciatic nerve.

“Goldthwait calls attention to the fact that the lumbosacral articulation varies greatly in its stability, and actual displacement of the bones may result, with separation of the posterior portion of the intervertebral disk. The cauda equina, or the nerve-roots, may be compressed. With displacement on one side the spine is rotated and the articular process of the fifth is drawn into the spinal canal, with such

narrowing that paraplegia may result, and he reports a remarkable case in which the paralysis came on during the application of a plaster jacket. Weakness of the joints or the partial displacements may cause irritation of the nerves inside and outside the canal with resulting bilateral sciatica.

"Of the branches, the sciatic nerve, when injured at or near the notch, causes paralysis of the flexors of the legs and the muscles below the knee, but injury below the middle of the thigh involves only the latter muscles. There is also anesthesia of the outer half of the leg, the sole, and the greater portion of the dorsum of the foot. Wasting of the muscles frequently follows, and there may be trophic disturbances. In paralysis of one sciatic the leg is fixed at the knee by the action of the quadriceps extensor and the patient is able to walk.

"Paralysis of the small sciatic nerve is rarely seen. The gluteus maximus is involved, and there may be difficulty in rising from a seat. There is a strip of anesthesia along the back of the middle third of the thigh.

"External Popliteal Nerve.—Paralysis involves the peronei, the long extensor of the toes, tibialis anticus, and the extensor brevis digitorum. The ankle cannot be flexed, resulting in a condition known as foot-drop, and, as the toes cannot be raised, the whole leg must be lifted, producing the characteristic *steppage* gait seen in so many forms of peripheral neuritis. In long-standing cases the foot is permanently extended, and there is wasting of the anterior tibial and peroneal muscles. The loss of sensation is in the outer half of the front of the leg and on the dorsum of the foot.

"Internal Popliteal Nerve.—When paralyzed, plantar flexion of the foot and flexion of the toes are impossible. The foot cannot be adducted, nor can the patient rise on tiptoe. In long-standing cases talipes calcaneus follows, and the toes assume a claw-like position from secondary contracture, due to overextension of the proximal and flexion of the second and third phalanges" (Osler).

SCIATICA

This is commonly a very painful and obstinate affection, which may last for years, and apt to recur upon a return of its exciting causes. The first question to settle is whether its cause is intrapelvic, or due to inflammation of the nerve itself after its exit from the sciatic notch. Thus, it may be occasioned by the disease of the spinal column, as in a severe case of my own, which presented all of the symptoms of extrapelvic sciatica, but which was finally relieved by the appearance of a

psoas abscess in the groin, proving that it originated from a tuberculous vertebra.

Among the commonest intrapelvic causes are chronic fecal accumulations in the descending colon, and I have often caused great relief by the administration of pills containing 1 drop of croton oil in 4 gr. of bismuth, given at night.

In all cases of sciatica great attention should be paid to the state of the portal circulation, and many patients with this complaint are relieved by a prolonged visit to Kissengen. It is an interesting fact that the Kissengen water is an almost exact reproduction of the constituents of the blood in their due proportion, but minus its corpuscles and albuminous ingredients; and a prolonged course of such mineral waters has the effect of unloading the portal circulation simply by an excess of the natural ingredients of the blood, which excess is gotten rid of with no drain upon the system at large. When the trouble is wholly of extrapelvic origin, its nature may be settled by an examination of the course of the nerves in the leg, when the most painful point on pressure may be found at the exit of the nerves at the sciatic notch, or down its course along the posterior aspect of the thigh, or in the popliteal space, or in the middle of the calf, where the nerve lies between two heads of the soleus muscle. If the whole nerve trunk is involved, pressure may be painful behind the external malleolus.

A severe case in my practice was that of a truck driver, who sat upon a small seat above his cart, which, on going over a log in the road, caused him to be thrown up so that he came down with much force upon his seat, and, I have no doubt, thus ruptured a vein within the sheath of the nerve.

Sciatica occurs particularly in men who are exposed to cold or to getting wet, and here it is important to settle whether the cause is simply a rheumatic inflammation of the sheath of the nerve or whether it be due to an actual neuritis of the nerve trunk; in that case the whole limb may feel cold, be stiffened, and its muscles atrophied.

Symptoms.—The symptoms of sciatica differ somewhat according to their causes. Necessarily, pain is aggravated by every movement of the leg, and in walking, when the movements are slow and the steps very short. The rule also is that the pains are more severe at night and not uncommonly paroxysmal, interfering with sleep, and may be so aggravated that strong men cannot avoid tears.

Treatment.—When the affection is due to a rheumatic inflammation of its sheath, it may be relieved by free administration of salicylates, but if the disease has already become a neuritis, these remedies are insuffi-

cient. Entire rest of the leg may then cure the patient by his going to bed and strapping the whole limb to a splint. Hydrotherapy is often very beneficial. The whole leg should be douched with hot water for fifteen minutes at a time, and then a hypodermic of cocain administered in doses of $\frac{1}{8}$ to $\frac{1}{4}$ gr. I have often supplemented this in chronic cases by the application of the actual cautery along the course of the nerves. This should be done only in one way, which is, to use an ordinary glass tube whose tip has been reddened in a flame of an alcohol lamp and then suddenly applied to the skin. When thus properly heated the epidermis snaps at the application, which should now be instantly withdrawn, and, if done properly, this leaves no sore behind. Much the most effective procedure, however, in my hands has been the introduction of the whole limb into what is called the hot-air box, which contains superheated dry air raised to 300° F., each sitting occupying about twenty minutes, once or twice a day.

HERPES ZOSTER

This complaint, commonly called *shingles*, is due to a lesion limited to the extraspinal ganglion on the posterior root of a spinal nerve which belongs to the sympathetic nervous system. The lesion in the ganglion is commonly found to be a hemorrhage into the substance of the ganglion, but in other cases is the result of a disorganizing inflammation; in either case its origin or cause is yet unknown. The results also are characteristically limited to the cutaneous distribution of the nerve affection; so limited are its manifestations that they afford valuable evidence of the anatomic distribution on the skin of the branches of the affected nerve. Hence, Dr. Head has been able to demonstrate by them that the area of the distribution of these nerves is according to segments, rather than by single or individual tracts of a spinal nerve. This distribution is demonstrable by cutaneous eruption, which is altogether different from that of any skin disease, and consists at first of a well-defined erythema, whose surface in a short time becomes covered with discrete, but closely contiguous vesicles. These vesicles at first contain a clear liquid. They are not umbilicated, like the vesicles of small-pox, but, like them, may become filled with the pyogenic organisms of the skin, which may give rise to ulcers at their base, and may leave scars to mark their situation. The peculiarity, however, of this eruption is that it never crosses the middle line of the body in front so as to appear on both sides.

Previous, however, to the appearance of the eruption the patient always has special premonitory symptoms. These consist of a slight

degree of fever, with very pronounced pain, limited to the distribution of the affected nerve. Thus, I have known of patients coming for consultation on account of the pain alone, referred by them to a single region in the back, and on being surprised, when the physician has had them stripped, to find the characteristic vesicular eruption there. Usually the pain accompanied by feelings of general malaise precedes the appearance of the vesicles by three or four days.

When the eruption appears on the trunk of the body there is little difficulty in recognizing its relations to ganglion of the posterior root, but is otherwise when the ganglion affected belongs to one of the cranial nerves. Thus, the sympathetic ganglion, called the Gasserian ganglion, which belongs to the third or sensory division of the trigeminus, may be affected, causing the eruption to appear first on the face near the eye, and which may extend to the eye itself, with the most serious results sometimes to that organ, for not only may the conjunctiva become implicated, but the cornea also may ulcerate, with further extension to the deeper parts. In some cases, however, the inflammation only causes adhesion of the iris to the anterior chamber.

The area occupied by the rash is either a part or the whole of the distribution of the ophthalmic division. It may extend as far back as the parietal eminence, and occupy the whole upper lid and side of the nose as far as the ala nasi. This implication of the side of the nose is an extremely important feature, for, as Sir Joseph Hutchinson first pointed out, the patients in whom this area of the skin is affected are peculiarly liable to suffer from ulceration of the cornea.

The pain which accompanies this localized affection is usually very severe, and hence the importance of the early diagnosis of the nature of the few vesicles which then appear about the external canthus of the eye, because to arrest the progress of the disease when it threatens such an important organ as the eye is imperative. This may be done by the administration of dram doses of the fluidextract of ergot, which I usually prescribe, combined with a dram of elixir of cinchona, to cause the medicine to be more acceptable to the stomach.

This affection may also be quite pronounced in other regions besides those already detailed. In my own case I was once severely affected by pain referred to the sacrum, followed by the eruption on the inner aspect of the thigh. The rule is, that though it may occur at any period of life, even in infants, it may be especially severe in the case of the aged, and leave them victims of severe neuralgic pains for many months. In an aged person these pains, of a darting or aching character, are apt to become very chronic. After the rash has died

away the area of the affected skin not infrequently remains abnormally tender to painful stimuli, such as the point of a pin dragged lightly across it.

Treatment.—It is noteworthy how common this affection is. I have found, for the severe pains of the acute stage, that nothing equals the administration of the fluidextract of ergot, as above mentioned. For the chronic neuralgias following the attack, especially in aged persons, I would use nitrate of silver in $\frac{1}{4}$ -gr. doses for a week, which may be intermitted when the pain subsides, but if they become at all severe, the ergot should be resumed, and meanwhile every measure for improving the general health adopted, such as iron with the syrup of the hypophosphites.

LANDRY'S PARALYSIS

I have seen only one case of this remarkable disease. The patient was a man much addicted to hearty eating. Going into a restaurant after being at a theater, he partook freely of Russian caviar. The next morning I went to see him for paralytic symptoms in both feet. He had no pains whatever, but a rapidly ascending paralysis of first his legs, then his arms, and then of the diaphragm. There was no affection at all of the sphincters. Death occurred in two days from respiratory paralysis.

MYELITIS

Myelitis, or inflammation of the substance of the spinal cord, is nearly always secondary to infection, but cases are reported as the result of direct injury, such as by blows or railway accidents. In other cases exposure to cold may be the cause in a similar way to that which we have described as the origin of poliomyelitis. Some cases undoubtedly have followed an overexertion, as among soldiers on long marches. Hemorrhages into the cord may also set up localized patches of myelitis. In other cases chronic endarteritis, causing ischemia, may lead to complete degeneration of the nerve tissue of the cord, as also may arteritis obliterans due to syphilis. With an affection of such various origins these differentiations of its forms may be difficult, while the symptoms, on the other hand, are more easily described. Thus, a transverse myelitis may occur at various definite levels, with the symptoms above referred to, of a cord or band across the body. Examination may then show an entire loss both of sensation and of motion in parts below, while at the zone of the sense of constriction there is just above it a hyperesthetic area in which sensations of pain may be elicited more readily than in health.

The first symptoms of myelitis may consist of numbness and tingling, especially in the lower extremities. Shortly afterward difficulty in micturition and then of emptying the rectum may set in. Thus, after injuries to the spine it is necessary to watch the condition of these organs, for not only may complete retention occur, but it is almost impossible to prevent inflammation of the bladder, following introduction of the catheter, by micro-organisms being introduced with this instrument. It is sometimes impossible to prevent infection in this way, because the urethra always abounds with septic organisms. The catheters, nevertheless, should be sterilized by immersion in a dram of carbolic acid to a pint of water. Another serious condition is the tendency to form bed-sores on the back. The back should be examined twice a day for the first signs of this complication. The skin of the back should be carefully bathed with a solution of 10 gr. of alum in 4 oz. of water, and pressure should be prevented by india-rubber rings which are sold for the purpose. I have found cotton-batting, readjusted twice a day, very serviceable in such cases. It is really incumbent to change the patient often from lying on his back to lying on his side, and in bad cases this should be at least once an hour, for a bed-sore, once formed, is very difficult to heal, and these easily become gangrenous, not uncommonly penetrating in their course to the spinal cord itself.

The best application I have found is an ointment composed of 1 dram of tannate of lead to 1 oz. of simple cerate, with the addition of 3 to 4 gr. of salicylic acid.

POTT'S DISEASE

This may be either easy or quite difficult to diagnose, because its symptoms are necessarily so varied. Thus, I was called to see a child who had been treated for worms because it complained of pain at the pit of the stomach. Not finding any rigidity of the muscles there, I turned it over to examine its spine, and found that one of the dorsal vertebra was quite tender to pressure, due to tubercular caries, without as yet any deformity. The first symptom in these may be only pain upon jarring the spine in descending stairs. A fixed pain in the back, whether in a child or in an adult, should always excite our suspicions and call for a searching examination. Tuberculous disease of a vertebra is the commonest cause of spinal symptoms, though such symptoms may occur without the vertebra itself being diseased. Thus, such symptoms, if they occur suddenly with much pain, may be due to hemorrhage within the spinal canal, but this is not common. The more

usual cause is from tuberculous infiltration of the membranes, particularly if subdural. But, however occasioned, pressure upon the nerves issuing from the spinal canal will be characterized by pains following distribution of the implicated nerves.

If the disease is high up in the neck the resulting paralysis may be the most widespread ever seen. I had a hospital patient who was threatened with death from paralysis of every muscle below the second cervical vertebra. Suspecting that it was syphilitic in nature, he was soon cured by intramuscular injections of corrosive sublimate.

Vertebral tubercular disease leads usually to kyphosis, commonly called humpback. The spinal cord then becomes compressed, producing motor paralysis of the parts below the seat of the disease. It is very desirable, therefore, to recognize the onset of this complaint—called Pott's disease, from the surgeon who first described it—early, so as to prevent the development of the deformity by proper appliances. One of the early symptoms, either of compression or actual myelitis itself, is what is called a girdle-pain, as if a cord or band were drawn tightly across the body. Not uncommonly the physician is called when the mischief has already happened, and all that can be done is to diminish the after-effects. If it is a mid-dorsal vertebra which is involved, contraction of the muscles of the legs may occur, drawing the heels up to the buttocks. The only treatment then is by persevering douches with hot water, three times a day.

If the lumbar vertebræ are involved the symptoms are more serious, because the sphincters, both of the bladder and of the rectum, are affected. Occasionally spinal symptoms are due to extension of processes occurring outside the spinal canal, such as the secondary growth from cancer or of aneurysm eroding the vertebræ, in both cases often producing agonizing pain.

NEURITIS

This term explains itself—namely, a nerve inflammation—and may be either strictly local or very general. One form, caused from a stretching of nerve-trunks in foot-drop, has already been alluded to in the treatment of typhoid fever.

The commonest cause of neuritis is from toxemia. Thus, it may occur in diabetics. In them it often begins as a sciatica, generally preceded by cramp in the calves of the legs and abolition of the knee-jerk, but I have known diabetic neuritis to be very local, involving only one nerve in the arm.

The most common cause, however, of a general neuritis is from the use of alcoholic stimulants, usually coming on gradually, but some-

times so suddenly that the patient falls from paralysis of the legs. As a rule, however, it is easily diagnosed by the presence of pains elicited on pressure of the affected muscles. When these pains are at all general in either the upper or lower limbs, by handling the affected muscles it is almost pathognomonic, and is a valuable sign in patients addicted to secret drinking, particularly in women, for they are at least four times as subject to alcoholic neuritis as men. One of the marked symptoms of these cases when severe is a wrist-drop, which differs from that in lead-poisoning by the pain which accompanies it, being either spontaneous or elicited by pressure. Not uncommonly alcoholic neuritis is accompanied by mental disturbances which may amount to delirium, or, in other cases, to the most varied hallucinations, when the patients will entertain you with accounts of purely imaginary events. Alcoholic neuritis does not often involve the cranial nerves, and in this differs from rheumatic neuritis, which is a frequent cause of paralysis of the lower branches of the seventh facial nerve.

Treatment.—The chief remedy for alcoholic neuritis is absence from its cause, namely, chronic alcoholic drinking. These patients, when taxed with the habit, are apt to deny it, because they have not been intoxicated at any one time. The fact is, that drunkards often escape alcoholic neuritis altogether, and it is rather the slow and habitual ingestion of the poison, particularly in women, which produces the neuritis. The gait might be confounded with the gait of locomotor ataxia, but differs from it in that the tabetic patient comes down heavily upon the heel, and then afterward lets the foot drop upon the floor. The alcoholic patient, on the other hand, lifts the whole foot high up, as if stepping over some obstacles, dropping it down upon the ball of the foot. The wrist-drop of alcoholics also differs from that in lead-poisoning, in that the hands are very sensitive to pressure.

Neuritis also occurs both in lead- and arsenic-poisoning, which have already been described.

ANGIONEUROTIC EDEMA

This is a name given to an affection limited to the vasomotor nerves. It is characterized by swelling occurring rather suddenly upon the skin resembling urticaria. It may involve the lips and the eyelids, and frequently comes out on the anterior surface of the abdomen. It may or may not be accompanied with severe itching, but

is often associated with violent internal cramps, and is almost invariably characterized by disturbances of digestion. These sudden swellings may be dangerous to life in some situations, for 2 deaths have been reported from involvement of the larynx. It is a remarkably hereditary or family disease.

Treatment.—The best treatment for it is by 15-gr. doses of calcium lactate, four times a day, and by intestinal antiseptics, such as sodium benzoate and sodium salicylate, each 10 gr., an hour after meals and at night.

CHAPTER XVIII

DISEASES OF THE CRANIAL NERVES

OLFACTORY NERVES

THE sense of smell is relatively unimportant in man compared to what it is in the dog, for instance, where the development of its power is astonishing. In us it is chiefly important in assisting the sense of taste, for by it alone we distinguish the different flavors of articles in our food. Thus, I had a delicate young lady who, on account of the loss of smell from an obscure cause, could not distinguish between tea and coffee, nor between the taste of broiled steak and a piece of broiled ham; meantime she could distinguish perfectly between non-volatile articles, such as the taste of salt and that of lemon. This loss of smell is familiarly known to us when we catch a cold in the head, and in such cases is then due to the swelling of the mucous membrane; but anosmia, or loss of the sense of smell, may be due to brain disease, and is then a serious symptom. A gentleman once consulted me because he had such dreadful odors constantly annoying him when he was awake. In time he died from brain tumor.

It is also frequently reported as an aura preceding an epileptic fit. This sense, therefore, should be tested in every case of supposed cerebral disease, when the examiner may find that its absence is the only symptom of serious organic change in the brain. In making such tests, however, no irritant agents, such as ammonia, should be tried, because they would affect the branches of the fifth nerve and have nothing to do with the olfactory nerve.

THE OPTIC NERVE AND TRACT

We have already spoken of the retina as an outlying department of the brain itself, from whose cells the optic tract itself virtually begins, for its axons degenerate from the retina up to the primary centers of vision when the eye is enucleated or otherwise destroyed. The retina is an extremely complex structure, consisting of no less than ten layers of cells; the more sensitive part to sight and, therefore, the most directly connected with vision is the spot on the retina called fovea centralis. The course, then, of the optic nerve is much the most complex

in the body, its fibers leading from the retina to the optic chiasm, where an intricate decussation of the fibers from the two eyes takes place. In the chiasm half of the fibers in each optic nerve directly decussate. In the lower animals, such as fishes, amphibia, and birds, the decussation of fibers in the chiasm is complete; but in the higher animals, such as in the mammalia and notably in man, many of the fibers do not decussate, but continue on the same side, while some fibers pass from one optic tract to another, probably to subserve binocular vision. After leaving the chiasm, the fibers of the optic tract make important connections with the lateral geniculate bodies, so that by many these geniculate bodies are considered to be the primary seats of vision. From the geniculate bodies a new set of neurons begin, which terminate in the convolution called the cuneus, along what is called the calcarine fissure, thus constituting the final cortical center of vision. But on the way from the geniculate bodies some fibers connect with the superior corpora quadrigemina, while others join the pulvinar portion of the optic thalamus, the thalamus being itself the great center in the brain for sensation.

Due to the distribution of the nerves, as above described, circumscribed lesion in one hemisphere may cause a person to see only half of an object, to which defect the term "hemipopia" has been given. This was first correctly defined in its nature by the celebrated English scientist, Wollaston, who detected it in his own eye while riding in a cab.

There are other ocular defects the result of organic changes that are described; some of these consist of diminution of the area of vision in the retina. Besides these, we have the striking condition called color-blindness. Derangements in this are nearly always congenital. Thus, I had a gentleman who never saw the color red, while his wife, on the contrary, was so fond of the color that both in dress and in house ornaments she would choose nothing but red. In her case I found she could not distinguish yellow from green. These defects in the color sense lead to sailors and railroad men having their color sense tested before they are engaged, because serious consequences may be entailed by their faulty perception of color in their business.

We have refrained from dealing with the subject of the treatment of derangements of vision, because the eye is such a delicate organ that, like the ear, its disorders should be treated by specialists.

ALBUMINURIC RETINITIS

Disturbances of vision, when due to organic changes in the optic tracts, may be either peripheral, so to speak, or centric. When per-

ipheral, its changes are in the retina itself, and, of course, can only be recognized by the ophthalmoscope. The commonest form of such changes is albuminuric retinitis, and very often is the first sign of interstitial nephritis. Patients may consult physicians for dimness of vision, little expecting the verdict of the examiner that they are already far advanced in serious kidney disease. The changes in the retina in this affection may either be degenerative or actually inflammatory. The degenerative forms are characterized by thickening and tortuosity of the blood-vessels of the retina, along with minute retinal hemorrhages and white patches following the course of the vessels. Such appearances are far more common in cases of chronic interstitial nephritis, accompanied by general arteriosclerosis and high tension of the pulse. They may occur, however, in parenchymatous nephritis, but are relatively uncommon.

The seriousness of this condition of the retina may be judged by the fact that most of such patients do not live a year from the time of its detection. If, however, the retinal hemorrhage is at the beginning so profuse as to destroy for a time the sight, the prognosis is not so unfavorable. I have a patient in which this actually occurred, and he told me that he had a brother who died from chronic Bright's disease, but he soon recovered his sight, and is now living, three years afterward, in apparent good health.

Retinitis also occurs as a part of impoverished condition of the blood from any cause. It is common, for example, in pernicious anemia, and is also met with in leukemia. It is not uncommon in tabes, although more frequently it is then preceded or accompanied by chorioiditis.

OPTIC NEURITIS

Inflammation of the optic nerve itself may occur, but oftener we have a combination of both neuritis and retinitis. The retina may be studded with hemorrhagic spots, red if recent, or black if chronic.

One form is of much interest when it is associated with the presence of a growing tumor in the brain substance. Usually a disturbance of vision is preceded in these cases by headache and vomiting. On ophthalmoscopic examination the condition termed "choked disk" may be found. It is in such cases that trephining the skull for the relief of intercranial pressure, which though only palliative, may afford great relief.

OPTIC ATROPHY

Much the commonest cause of primary optic atrophy is tabes, already referred to in the article on that disease, and, as there mentioned,

it is curious that the other symptoms of locomotor ataxia may be but little pronounced, while the blindness is total. A patient was once referred to me by a distinguished oculist, who, while totally blind from optic atrophy, yet showed very little ataxia in any of his bodily movements. The outlook in such cases is hopeless. The other causes that have been assigned for optic atrophy, such as diabetes and lead-poisoning, are chiefly hypothetical.

"The ophthalmoscopic appearances are different in the cases of primary and secondary atrophy. In the former the disk has a gray tint, the edges are well defined, and the arteries look almost natural; whereas, in the consecutive atrophy the disk has a staring opaque-white aspect with irregular outlines, and the arteries are very small" (Osler).

In many cases the onset is gradual, consisting in progressive failure, both in the acuity of vision and in the range of the visual field, as well as in the onset of color-blindness.

As to the other defects of vision, the eye is such a complex and delicate organ that its treatment should be referred to specialists.

THE TRIGEMINUS, OR FIFTH NERVE

The trigeminus, or fifth nerve, as is well known, is a mixed nerve, two of its branches being sensory and one motor. A primary affection of the sensory branches without neuritis is uncommon. I have seen only one case of it in a young woman who had total loss of sensation in half the face, and similarly within the buccal cavity; other than this complete anesthesia she had no other symptoms whatever, and particularly no pain. It appeared to have come on suddenly without any known cause. It is well to be careful, in affections of the sensory branches of this nerve, to note the conditions of the mucous membranes whose innervation is involved. Thus, not only is the conjunctiva on that side liable to be inflamed from want of the protective act of winking, in removing dust or other irritating particles from the eye, but serious ulceration of the cornea may take place. The mucous membrane of the nose is also dry, and thus abolishes the perception of volatile flavors, but the sense of taste itself may be diminished, owing to dryness of half the surface of the tongue. I have found it particularly necessary in such cases to watch against the development of herpes, which, besides attacking the eye, may also produce the most acute pain. For the treatment of this pain, and for the arrest of the ulceration, we have a specific in the fluidextract of ergot, for which a dram should be given every three hours.

Paralysis of the muscles supplied by the motor portion of the trigeminus—namely, the temporal and masseter muscles used in mastication—are rare, but tonic spasm of these muscles, causing trismus or lockjaw, are too familiarly known as invariable in tetanus; occasionally they occur in tetany, as already described. Temporary trismus is not infrequent in hysteria.

TRIGEMINAL NEURALGIA

In our chapter on Pain we showed in what respect a neuralgic pain differs from all other pains, in that it does not have the characteristics of either inflammatory, pressure, or of stretching pains, and is best exemplified by the degenerative pains, like those so-called lightning pains of tabes. But, in actual pathology, it is not easy to draw a hard-and-fast line, for in some pains, ordinarily called neuralgic, a true inflammatory element is often present. This is true of what is called trigeminal neuralgia or *tic douloureux* of the face. Thus, in the case of tabes, its violent shooting pains are not aggravated by movement of the part, nor are the nerves tender on pressure. In trigeminal neuralgia, on the other hand, the patient often dares not chew, and frequently abstains from eating altogether on account of every movement of the affected muscles of the face, even talking bringing on violent paroxysms of pain, and yet he often opens his mouth to squeeze the aching muscles of the part. In fact, some pathologists claim that the affected branches of trigeminus are really cases of localized peripheral neuritis.

In fully developed cases it is doubtful if any nervous affection can cause so much acute pain as we meet here; its causes merit serious attention. Probably its most frequent origin is from exposure of the face to cold winds. Thus, the city of Edinburgh, Scotland, is noted for the frequent occurrence there of this neuralgia, particularly among persons not native to that windy city.

Like other similar neuralgias, its victims are usually past middle life. One should learn the point of exit on the face of the three branches of this nerve. The exit of the superior branch is on the frontal bone, near the midway, over the orbit of the eye; the second, or superior maxillary branch, comes out on the malar process of the upper jaw; the third, or dental branch, is midway between the ramus and the chin. There can be little doubt that, as in other neuralgias of this class, some conditions of arterial sclerosis predispose to the affection, because the majority of the patients are past middle life. The first onset is commonly sudden, and often after a prolonged exposure of the face to cold.

It may last for several days or even weeks, and then subside, and the patient may fancy that he is permanently free from it, but it is sure to return, though perhaps not until the following winter. The interval between the attacks after this becomes shorter and shorter, until life is rendered a burden from the continuous and severe recurrent paroxysms. The pain is frequently a burning one. It makes the patient cringe, it causes a flow of tears, and in very many cases a sharp, quick contraction of the muscles of the face, a closing of the eye, and drawing up of the mouth. Mental emotion also may start the pain with great severity; the eye waters, and sometimes the secretion of the nose is increased.

The most common form of neuralgia is the *supra-orbital*, in which the pain is felt above the eye and at the notch or foramen through which the supra-orbital nerve makes its exit upon the forehead, and over the forehead and in the hair, as high as the vertex. In long-standing cases all three trunks may be involved. Sometimes the pain radiates into the eyeball, and occasionally pain in the eyeball is the only manifestation of neuralgia of the supra-orbital nerve. When the infra-orbital branch is the one which is affected, pain is felt upon the cheek and in the upper teeth, and especially in the antrum and malar bones. It may then get as far out as the temple and the lobe of the ear. When the third or lower branch of the nerve is affected, the pain is felt upon the cheek and lip and in the lower teeth, also within the mouth, even in the tongue, and in some cases the tongue is the chief seat of the pain.

Treatment.—There have been numerous measures and different drugs employed for the treatment of this painful affection, some of which are of undoubted efficacy; but I would first refer to a treatment of my own, of which the following is an illustrative case: A gentleman aged seventy-four contracted trigeminal neuralgia two years previously while sojourning in Edinburgh; he consulted a number of our most eminent neurologists, who recommended various remedies of repute, but without benefit; his sufferings were pitiable to witness, and were particularly apt to recur whenever he attempted to chew anything. I had him go to bed, and be attended by a day and night nurse, who kept him continuously under the effects of full doses of laudanum, 20 drops every two hours night and day, thus insuring that he should not at any moment be out of the influence of the drug; he often begged to have it intermitted, but this was not done; at times he was delirious, though at no time did he show symptoms of opium-poisoning. After the end of the week the pain left him permanently,

and he had no return till his death, when he was eighty-eight years old.

Some cases of this complaint are supposed to be malarial in origin, on account of the marked periodicity of the attacks, and authors recommend that they should be treated with full doses of quinin, such as 30 gr. at a time, three hours before the expected paroxysm, having taken the night before a mercurial purge. My own experience is that such attacks are often due to influenza, instead of malaria, but in either case I prefer that they should be treated by the fluidextract of ergot in teaspoonful doses, along with a teaspoonful of elixir cinchona, and taken either at the paroxysm or an hour before, with the addition of 12 gr. of quinin.

The patients naturally are anxious to find what the possible cause of their painful affection may be, and I rarely have met a case which has not had every affected tooth in his head extracted; but, while the condition of the teeth should always be noted, yet, in my experience, trigeminal neuralgia in any form is not found conjoined with dental disease.

Two drugs are justly of good repute in this malady. The first is aconitia or aconitin; some care has to be observed in the use of this drug, as it is a powerful depressant. The best preparation of this drug is Chapoteaux's pills, containing $\frac{1}{150}$ gr., or $\frac{1}{8}$ mg., which may be given at first once every two hours, guided by the effect, which is weakness of the pulse and a marked sensation of tingling and of numbness in the tongue and in the fingers. The patient meanwhile should not be walking about, and should be warned against any sudden muscular exertion.

The second remedy is gelsemin; this should be given in 10-drop doses of the tincture or the fluidextract until the physiologic effects are produced, which are a drooping of the eyelids and a difficulty in opening them. If the dose of 10 drops every three hours does not have any effect, it may be increased by 1 drop each time until the eyelids droop. I have found in administering doses of this drug that it also produces a sense of general prostration, in which case the dose should be decreased; but this remedy often succeeds when aconitin fails.

In gouty cases, which in this country are quite common, wine of colchicum in 5-drop doses every two hours may be given. If it produces loosening of the bowels it may be decreased or not given so often.

Of other drugs, the arsenic preparation called cacodylate of soda enjoys some repute— $\frac{1}{8}$ to $\frac{1}{4}$ gr. three times a day. It may be used

in conjunction with the remedies already mentioned, or alone, care being taken to avoid toxic effects.

If taken at the very beginning of an attack, 15 gr. of antipyrin with 1 dram of aromatic spirits of ammonia may cut it short.

A number of local remedies are recommended, but much the most efficacious of them is to rub the face frequently with a menthol pencil. Camphor and chloral, rubbed together into a paste and applied, have been of benefit. In cold-weather the patient's face should always be protected by a layer of cotton batting and oiled silk, the cotton being moistened with chloroform liniment. If the patient has a plain condition of arterial sclerosis he should take frequent doses of a solution of nitroglycerin, $\frac{1}{2}$ gr. in 6 oz. of water, the dose being one teaspoonful, gradually increased, until it produces a sense of throbbing in the temples.

Meantime the condition of the general health should be carefully attended to, as these patients are usually below par in this respect.

Of the various surgical procedures which have been attempted for relief from this complaint, the only one which promises permanent relief is removal of the Gasserian ganglion. This procedure, however, should never be attempted except by a surgeon of proved ability in similar operations.

PARALYSIS OF FACIAL NERVE

Much the commonest form of facial paralysis is that named after Bell, who first adequately described it, after producing it experimentally in dogs. The cause is usually a neuritis produced by exposure of the face to cold, where the nerve makes its exit at the stylomastoid foramen. Its symptoms then are very striking; the whole side of the face is immovable. In the forehead the normal wrinkles are obliterated, the eyelid droops, but cannot be closed, the eye waters. If the patient tries to smile the face is at once drawn to the opposite side. Owing to paralysis of the buccinator muscles, food collects between the cheek and the teeth, and in drinking some of the fluid may run out of the corner of the mouth. The paralysis of the nasal muscles is seen on asking the patient to sniff.

It is important to note whether in this paralysis the sense of taste is also affected on the corresponding side of the tongue. If the sense of taste is affected in the anterior part of the tongue on the affected side it shows that, besides the branches outside of the stylomastoid foramen, the nerve is also affected higher up in the canal, between the genu and the origin of the chorda tympani.

Treatment.—The most effective treatment for this affection is based upon the fact that it is really a neuritis, and counterirritation by a blister on the mastoid process behind the ear, applied once a week, is generally efficacious. Meantime, faradization can be used to the affected muscles, both poles being tipped with moistened sponges; one pole is applied at the nape of the neck, while the other is passed over the muscles of the face. In the majority of cases these measures amply suffice, while meantime potassium iodid may be taken, 10 gr. in water three times a day, an hour after meals.

SPASM

The muscles supplied by the seventh nerve are sometimes strikingly affected by spasm. This is particularly the case with blepharospasm, or spasm of the orbicularis muscle. This has sometimes been treated by full doses of the fluidextract of conium, and I knew of one case in which a poisonous dose of this drug was given by an oculist with a fatal result. I believe, however, that it would be best treated by the fluidextract of gelsemium in 10-drop doses, cautiously increased by 1 drop with each dose, until constitutional effects are produced. In some cases the spasm extends to all branches of the facial nerve, when the patient seems to be making constant grimaces.

Weir Mitchell recommends freezing of the cheek, for a few minutes daily or every second day, with ethyl spray, and this, in some instances, is beneficial. I would prefer the application of a liniment composed of an ounce each of the liniment of aconite, the liniment of belladonna, and the liniment of chloroform, with the addition of 1 dram of menthol, this to be applied on the face and then covered by cotton and oiled silk, three times a day.

AFFECTIONS OF THE AUDITORY NERVE

The ear, or the organ of hearing, is divisible into three parts, whose relations to one another should be distinctly remembered. The first is the pinna, or the external ear; the second is the external or auditory canal, which ends in the tympanic cavity; this canal is about $1\frac{1}{4}$ inches in length, its direction is obliquely forward and inward, and it is slightly curved upon itself. This curve makes it a little difficult to look through the canal so as to get a view of the tympanum, but by pulling up the tragus the curve is so altered that a view of the tympanum can be obtained. The office of the pinna is to collect the sounds as they come from all quarters and conduct them into the auditory canal. In man the pinna is scarcely movable, but in many of the mammals, such as

the equines, rabbits, etc., it answers an important purpose by its length and movability, enabling them quickly to detect the direction of the sounds much better than we can.

The tympanum is an irregular cavity, being a little broader behind and above than it is below and in front. It is filled with air, as is also the Eustachian tube which communicates with it. This tube is from $1\frac{1}{2}$ to 2 inches in length, with the direction downward, forward, and inward, opening in the pharynx on a level with the floor of the posterior nares. On that account no liquid injections should be made into the nose, for they can pass directly into the Eustachian tube and set up serious inflammation there.

The tympanum is traversed by a chain of little movable bones, three in number—the malleus, incus, and stapes—the latter so-called from its exact resemblance to a stirrup. The malleus is attached to the membrana tympani; the stapes, to the fenestra ovalis; the incus being placed between the two. The above-mentioned structures form the middle ear. The middle ear is separated from the inner ear by a membrane stretched across an opening called the fenestra ovalis, to which the stapes is attached.

The inner ear, or the labyrinth, begins at an opening called the fenestra ovalis. It is called the labyrinth from the complexity of its shape, and consists of three parts—the vestibule, semicircular canal, and cochlea. It is formed by a series of cavities channeled out of the substance of the petrous bone, communicating externally with the cavity of the tympanum through the fenestra ovalis and rotunda, and internally with the meatus auditorius internus, which contains the auditory nerve. Within the osseous labyrinth is contained the membranous labyrinth, upon which the ramifications of the auditory nerve are distributed.

What the old anatomists called the eighth or acoustic nerve is composed of two distinct nerves quite different in function. Thus, the *vestibular* nerve has nothing to do with hearing, and, instead, is distributed to the semicircular canals, whose business it is to maintain the equilibrium of the body. We have already described its functions in our chapter on Vertigo.

Our sense of hearing, instead, depends upon the integrity of the cochlea, which is an organ whose complexity is extraordinary; nothing, in fact, is so impressive as the minute structure and beautiful arrangement of the finer portion of this organ. The whole structure is estimated to contain about 24,000 strings, varying gradually in length, as stated. Within the cochlea, and bathed in its lymph, is an apparatus

of hairs of different lengths. The cochlea itself resembles a spiral snail shell, whence its name. Suspended in the endolymph is the basilar membrane; on this membrane are arranged a peculiar class of cells, called the rods of Corti, which number about 3000 pairs. Lying against the rods of Corti are certain other cells, called hair-cells, which terminate in small hair-like processes. When viewed from above the organs of Corti show a remarkable resemblance to the keyboard of a piano.

The path from the cochlear nerve extends to the brain cortex and terminates in the temporosphenoidal gyrus, which is the cortical center for hearing. In man this gyrus has centers differing in their functions: one is for the understanding of words; this may be separately diseased, when the person is said to become word-deaf. He may be able to appreciate all other sounds, but words convey no meaning to him. Another center close to it is the musical one. Thus, cases are reported of expert musicians becoming unable to tell one tune from another owing to damage to this center. Affections of any part of the ear which we have described may cause diminution or actual loss of hearing, and hence should lead to careful examination in any case of deficient hearing. Thus, the mere plugging of the external auditory canal by hardened wax may cause deafness, the removal of which may actually alarm the patients from the sudden restoration of their full appreciation of sounds. Much more common are affections of hearing from inflammations of the middle ear, or otitis media; in some of these cases inflation of the Eustachian tube, from its opening below in the pharynx, may greatly benefit the hearing. It is from neglecting to attend to otitis media that cases may occur in scarlet fever, which, beginning with a sore throat of the disease, may extend up the Eustachian tube and cause permanent deafness. We have already referred to this calamity as the frequent cause of deaf-mutism after scarlatina.

Inflammation at the base of the brain may involve the acoustic nerve, particularly in cerebrospinal meningitis. I had a case in which permanent total deafness occurred from this cause on the fifth day of the disease. Actual loss of hearing may occur from locomotor ataxia, and also from syphilitic exudation at the base of the brain, which may or may not be curable by large doses of potassium iodid. In one person of my acquaintance his trouble terminated in a series of convulsions in which he died.

Deafness is also very common from general arteriosclerosis and in the case of progressive loss of hearing so common in old age. The symptoms of this condition are simply those of increasing deafness

without any signs of pain or local inflammation. It is important, however, to know the cause, for in many cases by dealing with the arteriosclerosis itself, as we have mentioned in the chapter on that disease, the failing function of hearing may be considerably medicated.

In examination of the ear the watch should be first used to note the distance at which its ticking can be heard with both ears, for often the patient is surprised to find the difference between one ear and its fellow in this respect. If the patient can scarcely hear the watch, however close it is brought to the external meatus, it or a tuning-fork should be laid against the mastoid process. If it is then heard plainly, the trouble is not in the auditory nerve. Connected with the tympanum are the numerous cells which are found in the mastoid process behind the ear, and which, besides communicating with one another, enter the cavity of the tympanum by one or two openings. On account of this connection, inflammation of the middle ear may extend to the mastoid cells. In very acute suppuration of the middle ear the mucous membrane of the antrum and mastoid cells is simultaneously or consecutively affected, there being at first a simple empyema, and next, especially in infective cases or enfeebled individuals, implication of the bone of the nature of caries, and occasionally necrosis. This often becomes infected by invasion of streptococci, which, when it occurs, necessarily involves a surgical operation to let pus out.

The symptoms of this condition are pain radiating over the side of the head and tenderness on pressure over the mastoid process, with swelling of the tissues behind the ear; and, lastly, if this condition is not speedily removed by operation, an abscess may form in the brain itself which may soon terminate life.

Tinnitus aurium, or ringing in the ears, is a very common affection in persons past middle life. It is due to a number of causes, some but not many of which are owing to actual organic disease; usually, however, no cause can be assigned for it, so that authors speak of it as merely subjective. It is never pleasant to the patient himself, so is said in some cases to have actually led to suicide. My own view is that it is generally caused by derangement of the blood; thus, loss of blood or simple anemia may occasion it; in other cases a gouty condition is responsible, for in these patients treatment for the gouty condition does the most good. In the majority, however, arteriosclerosis is the chief cause. For the treatment for this troublesome symptom I have found nothing better than free dosing, three times a day, of 15 gr. either of the strontium or the ammonium bromid.

GLOSSOPHARYNGEAL NERVE

Derangements of the ninth (or glossopharyngeal) nerve of centric origin are quite uncommon, while peripheral derangements, due to changes in the mucous membrane of the tongue, are frequent in all fevers when dryness of the tongue is produced. At all times in such cases a wash of 10 gr. of chlorate of potash in 1 oz. of water should be frequently used to prevent fissures of the tongue. Occasionally in epilepsy the attack begins with an aura of a perverted sense of taste, but not so often as a perversion of the sense of smell. Both of these disorders once occurred in a patient of mine, and gave him great annoyance until he died suddenly, when a tumor was found which involved the origin of the olfactory nerve.

PNEUMOGASTRIC NERVE

Immediately following the centers of the glossopharyngeal nerve in the medulla are the centers of the great tenth, or the pneumogastric nerve. The tenth nerve has an important and extensive distribution, supplying the pharynx, larynx, lungs, heart, esophagus, and stomach. When its nuclei are affected in the medulla the symptoms may be those which are grouped under the name bulbar paralysis, and are then usually of toxic origin. Affections may occur, however, of each one of its branches separately, and may be considered in the following order: pharyngeal branches, in combination with the glossopharyngeal; the branches from the vagus form the pharyngeal plexus, from which the muscles and mucosa of the pharynx are supplied. In *paralysis* due to involvement of this, either in the nuclei, as in bulbar paralysis, or in the course of the nerve, as in diphtheric neuritis, there is difficulty in swallowing and the food is not passed on into the esophagus. If the nerve on one side only is involved, the deglutition is not much impaired. In these cases the particles of food frequently pass into the larynx and, when the soft palate is involved, into the posterior nares.

Laryngeal Branches.—The superior laryngeal nerve supplies the mucous membrane of the larynx above the vocal chords and the cricothyroid muscle. The inferior or recurrent laryngeal curves around the arch of the aorta on the left side and the subclavian artery on the right, passes along the trachea, and supplies the mucosa below the cord and at the muscles of the larynx, except the cricothyroid and the epiglottidean. Experiments have shown that these motor nerves of the pneumogastric are all derived from the spinal accessory. The remarkable course of the recurrent laryngeal nerves renders them liable to pressure

by tumors within the thorax, particularly by aneurysm. Paralysis of one or both vocal chords is sometimes the first sign of the presence of an intrathoracic aneurysm. The following are the most important forms of paralysis:

Bilateral Paralysis of the Abductor's Chord.—In this condition the posterior crico-arytenoids are involved and the glottis is not opened during inspiration. The chords may be close together in the position of phonation, and during inspiration may be brought even nearer together by the pressure of air, so that there is only a narrow chink, through which the air whistles with a noisy stridor. This dangerous form of laryngeal paralysis occurs occasionally as a result of cold or may follow a laryngeal catarrh. The posterior muscles have been found degenerated when the others were healthy. The condition may be produced by pressure upon both vagi or upon both recurrent nerves. As a central affection it occurs in tabes and bulbar paralysis, but may be seen also in hysteria. The characteristic symptoms are inspiratory stridor with unimpaired phonation. Possibly, as Gowers suggests, many cases of so-called hysteric spasm of the glottis are, in reality, abductor paralysis.

Unilateral Abductor Paralysis.—This frequently results from the pressure of tumors or involvement of one recurrent nerve. Aneurysm is by far the most common cause, though on the right side the nerve may be involved in thickening of the pleura. The symptoms are hoarseness or roughness of the voice, such as is so common in aneurysm. Dyspnea is not often present. The chord on the affected side does not move in inspiration. Subsequently the adductors may also become involved, in which case the phonation is still more impaired.

Adductor Paralysis.—This results from involvement of the lateral crico-arytenoid and the arytenoid muscle itself. It is common in hysteria, particularly of women, and causes the hysteric aphonia which may come on suddenly. It may result from catarrh of the larynx or from overuse of the voice. In laryngoscopic examination it is seen, on attempting phonation, that there is no power to bring the chords together (Osler).

Spasm of the Muscles of the Larynx.—In this the adductor muscles are involved. It is not an uncommon affection in children, and is called laryngismus stridulus, or spasmodic croup, and occurs in locomotor ataxia in the so-called laryngeal crisis.

Anesthesia may occur in bulbar paralysis and in diphtheric neuritis—a serious condition, as portions of food may enter the windpipe.

Cardiac Branches.—The cardiac plexus is formed by the union of

branches of the vagi and of the sympathetic nerves. The vagus fibers subserve motor, sensory, and probably trophic functions.

Motor.—The fibers which inhibit, control, and regulate the cardiac action pass in the vagi. Irritation may produce slowing of the action. Retardation of the heart's action has also followed accidental ligature of one vagus. Irritation of the nuclei may also be accompanied with a neurosis of this nerve. On the other hand, when there is complete paralysis of the vagi the inhibitory action may be abolished and the acceleratory influences have full sway. The heart's action is then greatly increased. This is seen in some instances of diphtheric neuritis and in involvement of the nerve by tumors, or its accidental removal or ligature. Complete loss of function of one vagus, however, may not be followed by any symptoms (Osler).

SPINAL ACCESSORY NERVE

The large external part is distributed to the sternomastoid and trapezius muscles. Paralytic affections of the branches of the spinal accessory result in difficulty of movement of the head. Thus, the patient rotates the head to the opposite side, but there is no torticollis, though in some cases the head is held obliquely. These affections, however, are uncommon compared with spasmodic contraction producing the well-known torticollis or wryneck.

Congenital shortening of the sternomastoid muscle, accompanied in some cases with facial asymmetry, has been mentioned by authors, but spasmodic wryneck is a not uncommon affection whose elements are not always easily diagnosed. In my experience it has been more an affection of women than of men, and may be very transient, but in other cases it begins with clonic spasm, and then passes on to persistent tonic contraction, naturally causing great distress to the patient. It may occur at all ages, but some of the worst cases that I have seen have been in elderly women.

The symptoms are usually well defined. In the tonic form the contracted sternomastoid draws the occiput toward the shoulder of the affected side; the chin is raised and the face rotated to the other shoulder. The difficulty of an accurate diagnosis of the affected muscles may occur, when not only the sternomastoid is affected, but in association with the trapezius and still more with the deeper muscles that move the neck. When the trapezius is affected the upper third of the muscle may not be involved at all, but if the whole muscle is affected the head is depressed still more toward the same side. In long-standing cases these muscles are prominent and very rigid.

The worst forms of this complaint are found in those cases in which the neck muscles are affected with clonic spasm, which comes on every minute or so, and in which the deeper muscles may also be involved, such as the splenius, which may be quite as often involved as the trapezius, and also the scalenus, or by the deep rectus and obliquus. In these different affections the face, chin, and the head itself may be drawn into extraordinary positions; in some cases the face looks upward instead of sidewise. Not uncommonly the contractions are painful or may produce a sense of distressing fatigue, with the further depressing fact that there is little prospect of cure, for if the affection seems to subside for a time, it is pretty certain to recur. One mitigating circumstance is that the contractions cease during sleep; in the waking state being often excited or aggravated by emotion.

It is natural that in obstinate cases the patients resort to surgery for relief, because all attempts to overcome the spasm by fixation of the head by any apparatus are intolerable. A surgeon, however, should not attempt to deal with the affected muscles, for, in my experience, surgeons cannot be sure what muscle or tendon is to be cut, and, instead, attention should be turned to branches of the accessory nerve itself, which should be resected as far as possible along the neck.

HYPOGLOSSAL NERVE

Affections of the hypoglossal or motor nerve of the tongue as separate or independent diseases are uncommon. Thus, in hemiplegia due to any of the ordinary brain lesions, the tongue is not affected, though the patient may be wholly unable to use it in cases of aphasia. It is then quite intact in all acts of mastication or deglutition, its nuclei in the medulla, however, being sometimes involved in bulbar paralysis or possibly in tabes.

CHAPTER XIX

DISEASES OF THE CEREBRAL ARTERIES

APOPLEXY

LESIONS of the brain, according to their nature and location, produce mental results which raise the whole question what a human being is, in contrast with other earthly beings. Thus, speech is an exclusively human faculty. But I had a lady patient who woke one morning to find that she was wholly illiterate, for she could not read a word in any language, though she could hear and speak as well as ever; another, a gentleman, who suddenly became unable to read his native English, but could still read classic Greek; another, who could hear the clock strike, but could hear no word to understand it, not even his own words, so that he uttered an unintelligible jargon, while he understood what was said to him and could read as well as ever; another, who could utter no words, but still could sing them; another, a tailor, who overnight permanently forgot his trade and had to learn another one.

Now, in all these instances what was lost was not congenital, but acquired. But what was it which was acquired? An anatomic seat in the brain for each of these acquirements, and when that physical place was damaged the corresponding acquirement was lost.

But all these facts fail to carry us far enough, because we know that brain matter as such cannot acquire anything new or non-congenital, since one-half of brain matter remains without a single acquirement of these marvelous mental endowments characteristic of a human person. It is only the left hemisphere in right-handed persons and the right hemisphere in the left-handed which can be human in faculty.

It is, therefore, not the brain, but the person man who can fashion those physical seats of mental faculty in their cortical situations.

Being physical, these seats of mental faculty can be physically injured, and this occurs almost wholly from something going wrong, not in the brain, but in the brain's blood-vessels. This fact calls for the most painstaking study of the cerebral circulation, because no calamity can be greater than that a little artery should let blood escape into surrounding brain matter through such a minute hole in the vessel wall

that it may be difficult to find it. If the patient survives, his subsequent history may make one wish that he had died on the spot. The causes of blood-vessel diseases, therefore, are among the most vitally important subjects in medicine.

We begin with the circle of Willis, that arterial ring at the base of the brain composed of a branch of each internal carotid and each vertebral artery. As we proceed, however, we find that the cerebral vessels are subject to lesions entirely of their own kind; namely, in the form of various small so-called miliary aneurysms, the rupture of any one of which produces an effusion into the brain substance, which, according to its situation, may produce either apoplexy or hemiplegia. Many questions here meet us about the genesis of these remarkable aneurysms because they do not resemble any other aneurysms. Charcot regards them as due to periarteritis, and thus to weakening of the adventitia or outer coats. Other authors, like Birch-Hirschfeld, ascribe them, and, in my opinion, with most probability, to lesions in the intima, while others, like Roth and Lowenthal, to lesions in the media. These divergent views only illustrate the uncertainty which still surrounds this subject.

It is very probable that the weak support of surrounding brain matter renders the cerebral arteries more liable to localized lesions than arteries between strong muscular tissues or in solid organs. Back, however, of the chief causes of arterial disease there is no difference of opinion, for undoubtedly blood-poisoning from imperfect elimination by the kidneys constitutes the commonest cause of arterial weakening everywhere in the body. The frequency of apoplexy and of hemiplegia in persons with chronic interstitial nephritis lends support to this view; but another factor also enters here, and that is, hypertrophy of the left ventricle of the heart in arteriosclerosis due to embarrassment of the arterial circulation all over the body. This renders the cerebral arteries subject to unusual strain, whether during such acts as heavy lifting or the effect of emotion hurrying the circulation. Many cases, therefore, of apoplexy and hemiplegia can be directly traceable to such causes.

As we have said, apoplexy is not due to any brain fault, but is exclusively caused by something going wrong in a cerebral artery. This may be of more than one kind—one would be by the sudden plugging of a cerebral artery by an embolus. In such cases the vessel may be perfectly healthy, and the embolus plugs it by reaching the vessel through the blood, generally from as distant a source as a valve of the heart. Thus, a lady patient of mine suddenly lost all power of

speech and never regained it. I had long known that she had a strong musical murmur at the aortic orifice, which disappeared as soon as she had her accident. These emboli detached from a diseased valve may take a very different course from that to the brain. I had a gentleman whom I knew to be affected with valvular disease, who first had a severe pain in the spleen, then, after an evening spent in dancing, he had another severe pain in his left kidney, accompanied with profuse hematuria, and, lastly, while quietly reading a novel in bed, he laid his book down and instantly died. At the postmortem we found that the cause of death was a minute embolus which plugged an artery in the floor of the fourth ventricle, just above the calamus scriptorius or respiratory center. An accident may not be from an embolus, but from a thrombus. These are due to a precipitation on a valve, or, in the course of an artery, of fibrin, and this may be dislodged, so that it will closely resemble the effect of an embolus. But in many cases thrombi may form gradually, and, therefore, may cause their symptoms not suddenly, but relatively more slowly. A patient with cerebral thrombosis may, therefore, be at first conscious, but, as the thrombus increases in size, he may have his symptoms change accordingly. It is often a question whether a cerebral lesion is hemorrhagic, embolic, or thrombic. In favor of its being due to thrombosis is the previous presence of disease in the arteries, whether of the nature of atheroma or of a regular calcification in the walls of the blood-vessels. Thus, an embolus may occur in a perfectly healthy artery, but a thrombus is usually caused by long-standing arterial disease. When the case is one of true apoplexy we should take several considerations into account. One is that apoplectic attacks are apt to occur after hearty meals, the explanation of which is that there is a striking provision in the functions of the kidneys to eliminate a much greater quantity of urea after a meal than before it. This provision is to maintain the balance of the circulation, so that when much is added to it the kidney should correspondingly be more active in its elimination. Should, however, the kidneys be diseased, vascular disorders are quite sure to accompany it, and hence they may be unable to respond promptly to the demand made upon them. The attacks of apoplexy may be very sudden and quickly followed by death. In other cases the patients may suddenly feel faint and fall, shortly afterward becoming unconscious, particularly if, which is very common, they have attacks of vomiting. From the congestion of the head produced by the act of vomiting it is to be avoided as much as possible, usually by a patient being immediately made recumbent. Should the physician being called to a case for the first time find a

patient comatose, he has immediately to decide what the cause of the coma is. It may be from a blow on the head. Thus, I had a hospital patient who was admitted with no history. He was laughing and acting in a very silly manner, and, moreover, he had an alcoholic breath. I hastily concluded that he was drunk, but before I left the hospital I was called to see him again and found him dead. Postmortem showed that he had a large subdural blood-clot, caused by his having been struck by a sand-bag while in a drunken row.

But the patient may be suffering from uremic coma, in which case the pupils may be irregular and also the breathing. The pulse in apoplexy and also in uremia is generally full and of high tension. In apoplexy, however, the movements of the hands should be very carefully noted. The one hand will be found not to move, while, if the arm be raised and then dropped, there will be a marked difference between the two sides, the paralyzed arm dropping at once, while the other arm is much slower in falling; or the patient may be suffering from diabetic coma, in which case the breathing is usually very shallow, and there will be a sweetish odor to the breath; or the patient may be comatose from a poisonous dose of opium; in this latter case there will be symmetric contraction of the pupils and slow breathing.

Apoplexy from effusion of blood, if the patient survives, will soon show the signs of hemiplegia present in the face and in the arm and lower extremity on one side. In the face there will be an alteration in the lines of the cheek and the mouth on one side compared with the other, with the signs of paralysis of the upper and lower extremity we have already alluded to. The subsequent history when the patient has recovered consciousness differs according to the case. If the paralysis is on the right side, and the patient is as usual right-handed, he will also have aphasia, but, though he cannot use his tongue for speaking or protruding it when asked, he can use the tongue as well as ever in the act of swallowing. In these cases the arm is usually more paralyzed than the leg.

Changes in the brain tissue are not uncommon effects of apoplexy or of closure of the blood-supply to a part due to an embolus or to a thrombus. After a branch of a cerebral artery has been plugged by an embolus or closed by a thrombus, changes often occur in the territory supplied by the affected artery which are of the nature of softening. If the artery implicated belongs to the cortex these anatomic changes are not very pronounced, because of the numerous anastomoses of the cortical blood-vessels. But if they occur in the region of basal ganglia the effects are more serious, because the arteries here are ter-

minal and do not anastomose. The part supplied by the affected artery then becomes first necrosed, and soon breaks up into a softened tissue which may be absorbed, leaving a scar or, instead, form a cyst.

Treatment.—The symptoms accompanying an attack of apoplexy may be of two opposite kinds. In the first the face is flushed, the pulse full, and of high tension. If this persists for more than an hour the indication is to bleed the patient until the pulse becomes soft. In other cases the face is pale and the pulse weak, conditions due to general shock. In such cases stimulants may be cautiously administered, the best of which is brandy, to be discontinued so soon as the signs of reaction set in. Absolute bodily quiet is imperative in all forms. Meantime the bowels should be opened freely. If the patient in coma is unable to swallow, 1 or 2 drops of croton oil should be placed on the tongue, for this soon acts on the bowels.

HEMIPLEGIA

The different features of hemiplegia follow, and may be the most permanent results of an attack of apoplexy. We have already spoken of the early recognition of hemiplegia as it shows itself in paralysis of muscles in the face, arm, and leg on one side. Usually the muscles of the neck and of the ribs escape, which is explained by Broadbent as due to their innervation being bilateral in the brain and medulla instead of unilateral. One of the early signs may be a rigidity of the muscles on the affected side, which must be distinguished from late rigidity, for early rigidity may not last longer than one day, while late rigidity comes on slowly, and may last for the rest of the patient's lifetime. The patient should be watched at the beginning, that he does not throw his hand, foot, or leg out of the bed from reflex movements proceeding from the spinal cord. Here we may say that the physician in every case of apoplexy, with or without hemiplegia, should be careful to percuss over the pubes to determine whether there is retention of urine in the bladder. I have known of serious results coming from forgetting this precaution, because retention of urine after such cerebral accidents is apt to occur. The condition of the back should be noted at every visit for the first signs of the formation of a bed-sore, which is particularly prone to occur after dribbling of urine from an overdistended bladder. Quiet from bodily movements is necessarily incumbent after apoplexy or hemiplegia has occurred, and it is only when the chronic effects of paralysis have developed that anything but quiet is indicated. The patient or his friends may importune the physician to use every means for restoring muscular power, and particularly ask

for the employment of electricity, but the latter is absolutely useless at this stage for any purpose. As soon as all irritative symptoms have subsided, the patient may be allowed to sit up and attempt to walk. His gait, then, is quite characteristic, because the leg hangs helpless from the pelvis down; but, as the trunk muscles still act, he swings the leg from the pelvis in a curved line, the toes, however, scraping the floor. This movement at once differentiates the walk from that of hysteric hemiplegia, for in that affection the foot is dropped flat in the movement of the body.

After a time, late rigidity sets in, beginning usually with the paralyzed hand, and in which the thumb is strongly flexed into the palm. The forearm also is flexed and drawn inward toward the middle line, in some cases making it impossible to straighten the arm.

Meantime there is always an increased knee-jerk on the sound side. In time the nutrition of both the skin and of the muscles suffers on the paralyzed side, the limb feels cold, and its muscles atrophy, particularly if the late rigidity is pronounced. In most cases sensation is not nearly so much affected as motion.

The *treatment of the late results of hemiplegia* is first to counteract the results of late rigidity. We have only one agent which at all relieves this muscular condition, and that is the douche of hot water, applied night and morning. Now we may find electricity of service by using the faradic current on the paralyzed muscles, group by group, for this current always increases the flow of blood through the muscles, and thus helps to keep up its nutrition.

This is the proper place to mention that valuable sign in organic nervous lesions called *Babinsky's reflex*. This reflex is elicited by tickling the inner surface of the sole of the foot, when the behavior of the toes ought to be specially noted. In health the great toe is strongly extended, while the other toes are flexed, but when this result does not occur, it is a sure sign of organic change in the spinal cord. This reflex does not occur in hysteria.

"The facial or seventh may be paralyzed by (a) lesions of the cortex—supranuclear palsy; (b) lesions of the nucleus itself; or (c) involvement of the nerve-trunk in its tortuous course within the pons and through the wall of the skull.

"(a) Supranuclear paralysis, due to lesion of the cortex or of the facial fibers in the corona radiata or internal capsule, is, as a rule, associated with hemiplegia. It may be caused by tumors, abscess, chronic inflammation, or softening in the cortex or in the region of the internal capsule. It is distinguished from the peripheral form by well-marked

characters—the persistence of the normal electric excitability of both nerves and muscles, and the frequent absence of involvement of the upper branches of the nerve, so that the orbicularis palpebrarum, frontalis, and corrugator muscles are spared. In rare instances these muscles are paralyzed. In this form the voluntary movements are more impaired than the emotional. Isolated paralysis—monoplegia facialis—due to involvement of the cortex or of the fibers in their path to the nucleus is uncommon. In the majority of cases supranuclear facial paralysis is part of a hemiplegia. Paralysis is on the same side as that of the arm and leg, because the facial muscles bear precisely the same relation to the cortex as the spinal muscles. The nuclei of origin on either side of the middle line in the medulla are united by decussating fibers with the cortical center on the opposite side. A few fibers reach the nucleus from the cerebral cortex of the same side, and this uncrossed path may innervate the upper facial muscles.

“(b) The *nuclear paralysis* caused by lesions of the nerve-centers in the medulla is not common alone, but is seen occasionally in tumors, chronic softening, and hemorrhage. It may be involved in anterior poliomyelitis. In diphtheria this center may also be attacked. The symptoms are practically similar to those of an affection of the nerve-fiber itself—infranuclear paralysis.

“(c) *Involvement of the Nerve-trunk*.—Paralysis may result from involvement of the nerve as it passes through the pons, that is, between its nucleus in the floor of the fourth ventricle and the point of emergence in the posterolateral aspect of the pons. The specially interesting feature in connection with involvement of this part is the production of what is called alternating or *crossed paralysis*, the face being involved on the same side as the lesion, and the arm and leg on the opposite side, since the motor path is involved above the point of decussation in the medulla. This occurs only when the lesion is in the lower section of the pons. A lesion in the upper half of the pons does not involve the fibers of the outgoing nerve on the same side, but the fibers from the hemispheres before they have crossed to the nucleus of the opposite side. In this case there would of course be, as in hemiplegia, paralysis of the face and limbs on the side opposite to the lesion. The palsy, too, would resemble the cerebral form, involving only the lower fibers of the facial nerve” (Osler).

Treatment.—Besides the measures which we have enumerated for the treatment of the late rigidity of the muscles, local attention to the paralyzed muscles should be tried. Such muscles are very prone to atrophy, and their circulation becomes deficient, the paralyzed parts

feeling cold. It is then that the faradic current should be used to restore the circulation and nutrition of the palsied parts, and so far as possible each muscle or group of muscles should be traversed by this current. If any rigidity still remains, the hot-water douche should be used to relax it, and then the electricity immediately applied. By perseverance in these measures it is often gratifying to note how the nutrition of the muscles may be preserved, and we should always have recourse certainly at first to them, for we can never be sure whether the paralysis is going to remain complete or be partial. On the same principle, whatever keeps up the local circulation should be thought of, and hence massage and passive exercise of the parts should be resorted to twice a day, care being taken not to commence massage until we are sure that the immediate effects of the lesion have passed off.

In conditions both of apoplexy and hemiplegia the eyes may be examined to note what is called conjugate deviation, meaning that both eyes are turned to one side. Osler says:

"Conjugate Deviation.—In a right hemiplegia the eyes and head may be turned to the left side; that is to say, the eyes look toward the cerebral lesion. This is almost the rule in the conjugate deviation of the head and eyes which occurs early in hemiplegia. When, however, convulsions or spasm occur, or the state of so-called early rigidity in hemiplegia, the conjugate deviation of the head and eyes may be in the opposite direction; that is to say, the eyes look away from the lesion and the head is rotated toward the convulsed side. This symptom may be associated with cortical lesions, particularly, according to some authors, when in the neighborhood of the supramarginal and angular gyri. It may also occur in a lesion of the internal capsule or in the pons, but in the latter situation the conjugate deviation is the reverse of that which occurs in other cases, as the patient looks away from the lesion, and in spasm or convulsion looks toward the lesion."

With reference to **hemorrhage in the crus**, Osler states:

"Crus.—The bleeding may extend from vessels supplying the corpus striatum, internal capsule, and optic thalamus, or the hemorrhage may be primarily in the crus. In the classical case of Weber, on section of the lower part of the left crus, an oblong clot, 15 mm. in length, lay just below the medial and inferior surface. The characteristic features of a lesion in this locality are paralysis of arm, face, and leg of the opposite side, and oculomotor paralysis of the same side—the syndrome of Weber. Sensory changes may also be present. Hemorrhage into the tegmentum is not necessarily associated with hemiplegia, but there may be incomplete paralysis of the oculomotor nerve, with dis-

turbance of sensation and ataxia on the opposite side of the body. The optic tract or the lateral geniculate body lying on the lateral side of the crus may be compressed, in which event there will be hemianopia."

INSOLATION, OR SUNSTROKE

There is no physiologic fact more interesting than the extraordinary uniformity in the degree of the blood-heat in man, however different the heat may be outside of his body. Thus, the temperature of the blood is the same whether he be on the shores of the Arctic Ocean or at the equator—namely, 98.5° F. The blood of the internal organs, especially when they are active in function, may rise one degree above this point. On the shores of the Red Sea the average temperature of the air is 22° F. above that of the blood, but this has no effect whatever in altering the normal figure.

In the latter part of the eighteenth century Dr. Bladgen, president of the Royal Society, with Dr. Fordyce, having noted how certain showmen went into ovens and there baked bread, concluded themselves to perform the same experiment. They stayed in the oven until they cooked a beefsteak in thirteen minutes; while they were doing so their breath on their hands felt decidedly cold, and they could not touch their watch chains because they were so hot. Meanwhile the thermometer under their tongues did not vary from the normal. This proves that if the temperature is either above or below normal that such changes must be due to internal and not external causes. But it was not until our day that the thermometer was used for such important purposes as it is now for judging the conditions of the body in disease.

One of the most noted places for the occurrence of sunstroke is New York City. During the hot days which close the month of June and the beginning of July, when deaths from insolation may reach 75 a day, I have gone into my wards at the Roosevelt Hospital to find a scene that would resemble a battlefield, from the number of persons who were lying on the floor unconscious, the attendants waiting for the opportunity to put them in ice-water baths. Much the greater number of such cases were draymen, exposed to the sun as they drove about the city, but it was very noticeable how, upon investigation, the majority of these men were consumers of alcohol.

I was struck in reading the life of the celebrated British general, Sir Charles Napier, how he ascribed his immunity from sunstroke, compared with that of his fellow officers, to his total abstinence from liquors during an active campaign on the hot plains in the Punjab.

As we have remarked before, the most important center of the vasomotor system of nerves is at the nape of the neck, for it controls the circulation of the head and face, and, moreover, has close relation to the action of the heart and the circulation of the lungs. It is on the vasomotor system that the chief derangements of the circulation occur from the effects of sunstroke. Thus, in persons who recover, the majority will suffer for years or life from flushing of the head and face on slight causes, and from palpitation or giddiness. Conscious of their loss of self-control they have no confidence in themselves, and remain permanently unable to expose themselves to the hot sun for the same reason. They are also very liable to have frequent headaches.

The immediate symptoms of sunstroke vary in different cases. One form is that of general prostration, not unlike persons who have had an attack of syncope from which they have not recovered. In them the pulse is weak, the countenance pale, the breathing short and rapid, and the skin actually cool to the touch; the temperature, however, measured by a thermometer in the rectum, may be high.

But so long as the skin feels cool to the touch and the pulse is weak, heart stimulants should be freely used, of which far the best is the hypodermic injection of $7\frac{1}{2}$ gr. of camphor in sterilized almond or olive oil.

The most common effect of sunstroke, however, is to produce hyperpyrexia, the temperature rising from 106° to 110° F., sometimes reaching the higher figure after death. This hyperpyrexia is one cause of the patients being frequently comatose when they are brought in. As we have remarked when speaking of the hyperpyrexia which sometimes occurs in rheumatic fever, the only effective remedy is the ice-bath. On emersing the body in the water, the head should have an ice-cap applied to it, and then, as in the case of rheumatic fever, the temperature should be carefully watched and the patient removed before the thermometer has dropped to 100° F., the surface circulation being kept up by active rubbing. As we have remarked before, the first effect of emersing in the bath is to raise the temperature from one to two degrees, but it soon falls by the time the patient recovers consciousness. Usually in insolation the temperature does not rise again after the bath, while in the hyperpyrexia of rheumatic fever it may progressively rise in the course of an hour toward its former figure, and calls for, it may be, ten successive baths.

In many cases patients are taken with thermic fever while they are not exposed to the sun, but only suffering from the excessive heat of the air; they are then said to be sufferers from heatstroke. Sir

Joseph Fayrer reports numerous cases, in his large experience in India, where the patients were overcome while they were in bed, either on ship-board or on land; these patients present all the characters of the effects of sunstroke itself, either of great prostration, with symptoms of heart failure or an active delirium, or occasionally with signs of apoplexy or even of hemiplegia. The treatment, however, is the same as that given for sunstroke.

The knowledge of the after-effects of sunstroke should be borne in mind by every physician; the derangements due to injury or paralysis of the vasomotor centers may continue for years. We have very few remedies for this, except one, which should be daily resorted to for months. On rising in the morning a douche of two or three pitchers of cold water should be poured upon the nape of the neck, followed by friction. Care, however, should be taken meanwhile to protect the hair from being wet by use of linen towels. Occasionally, though not commonly, it is the splanchnic nerves which are affected, with disturbances in the circulation of the abdominal viscera, especially after heat-stroke, in which case the douche should be applied to the lower part of the spine. I have thought that the nitrate of silver in $\frac{1}{4}$ -gr. doses is a good remedy in vasomotor complaints, but after using these doses for six weeks this drug should be omitted. The same doses of the sulphate of zinc or the sulphate of copper may be substituted.

Examination of the body after death from sunstroke frequently reveals an extraordinary prevalence of what are called the terminal infections by bacteria, which are found in great numbers in the brain as well as elsewhere. It is doubtful, however, whether these are not the results of postmortem changes.

CHAPTER XX

DISEASES OF THE BRAIN

INTRODUCTION

IN former times edema of the brain was considered to be a frequent complaint, so that authors spoke of serous apoplexy. We now know, however, that it is very uncommon, and when a brain is found to contain an abnormal quantity of serous or watery fluid in its substance it is mostly due to a general dropsical condition in the body, commonly found in parenchymatous nephritis; it is, therefore, not a morbid condition by itself.

Delirium.—It is very natural that the laity should ascribe delirium to an affection of the brain. The fact is, however, that the brain is but rarely affected in cases of delirium. Thus, among the acute inflammations, croupus pneumonia is marked in its course with continuous delirium until the crisis occurs, but when the case ends in death the postmortem derangements are limited to the lungs and not at all to the brain. So in all kinds of delirium, as in typhoid fever, the case is just the same, so far as the brain is concerned.

But we may go even further, and see that in cases of true insanity the brain after death is found absolutely normal, except in paresis or general paralysis of the insane, in which the brain is organically affected much as the spinal cord is affected in tabes, and for the same reason, that it is a chronic result of the virus of syphilis. Hence, delirium is not due to derangement of the brain, but to various derangements of the blood, and most cases of insanity are best treated as blood disorders.

APHASIA

The faculty of speech is exclusively human. It is the highest and, at the same time, most artificial of endowments, because it depends upon the integrity of its anatomic seats, which are themselves created by the person himself, for no one else can do it for him. Thus, when one learns a new language, he cannot do so by proxy. But when he has learned it, its words are deposited in his brain on a distinct layer of brain tissue resembling the different wax leaves of a phonograph. Now these speech layers may be separately damaged, while the others

remain intact. Thus, many cases have been reported of persons who have learned French or German after their native English, and have suffered some injury, like an apoplectic clot, which destroyed their English layer, so that subsequently they could speak only in the later acquired language.

The point of interest here is that the speech-centers in the brain are never congenital, but are made by the speaker. The first attempts of a child are by gesture, and gesture language remains an important department of speech to the end of life; therefore the most used hand in childhood settles which of the two cerebral hemispheres shall contain the anatomic seats of speech, and hence these will be found in the left hemisphere of right-handed persons or in the right hemisphere of the left handed.

Further investigation shows that, according to its anatomic seats, speech is either sensory (consisting of words that come to us either through the ear in listening or, again, through the eye in reading) or motor, which are words which we ourselves utter by the complicated apparatus of the muscles of the larynx, tongue, and lips, or by the hand in writing.

The different anatomic seats of words are in the first temporal convolutions for words which reach us through the ear, and the angular gyrus for words which come through the eye. The anatomic seats of motor speech are at the base of the third frontal convolution, called Broca's convolution, or its neighborhood. The seat of writing is not so well determined, but recent researches render it probable that it is in the posterior part of the second frontal convolution. There can be no doubt that the center for arithmetic figures must be quite separate from either of these. I had a patient who was perfectly word-blind, so that he could not read, and who also could not utter a single word, but who could both read and write and calculate the most complicated arithmetic figures in his business. These facts can all be demonstrated by postmortem findings. Limited lesions in the temporal convolutions have been found which caused total word-deafness without any other kind of deafness. These patients cannot hear their own words, so that when they speak they use an unintelligible jargon. Limited lesions in the angular gyrus also produce total word-blindness, so that the patients see everything well except words. Likewise, derangements of motor speech are very common, in which, owing to injury of its centers, the patient, though he can hear and see words, is yet totally unable to utter them.

More than anything else, the study of aphasia has led to the discovery and definition of those most important subcortical fibers in the brain which are called association fibers. These are very numerous, so that they constitute the chief part of the white substance of the brain. Their office is to bring into relation the different psychical or mental operations. Thus, we have spoken of the centers for word hearing, word seeing, and word uttering, but if we were furnished with only those centers our speech would be scarcely better than that of parrots. It is by means of these numerous association fibers that the different cortical centers are made to work together.

We may here pause for a moment to explain the mechanism of dreams. In dreams we have the same subjective acts of seeing, hearing, and feeling which we have when awake, and on that account, however absurd, they never excite wonder, for the centers are working independently without the correction of association fibers.

"These association fibers may be quite short when they pass between adjacent convolutions, but both long and broad in the tract which passes from the frontal lobe, collecting its bundle from all three convolutions backward to the occipital lobe.

"A second tract joins the occipital with the anterior part of the temporal lobe, a third tract passes from the upper two temporal convolutions forward to the third frontal convolution, and a fourth tract passes from the frontal to the posterior temporal area" (Starr).

Without these association fibers intelligible speech would be impossible, but the different speech disorders can frequently be distinguished by the signs which indicate lesions in the cortical centers themselves, or in the subcortical distribution of the association fibers. These latter produce mental derangements, so that we can speak of word-blindness as such, or psychical word-blindness, and these same terms may be used for the other derangements.

From the nature of the disorder, instances of aphasia which can be certainly accepted as affording clinical evidence of definite localization of speech centers are necessarily few. The lesions must be too exclusively limited to the speech centers or their connections to be at all common even from trauma, and still less from disease. When important centers other than the speech centers are also involved, as in every case of hemiplegia, the inferences become quite uncertain. On that account, in a hospital and private practice of forty years, I have seen only 3 cases which, to me, are conclusive, but conclusive they are, for reasons which I should illustrate in this way:

If I telephoned from my house in New York to a friend downtown, asking him to telegraph to a gentleman in Newark, requesting him to write a letter to his Congressman at Washington about a bill in Congress, and then report back to me the result, here telephone, telegraph, and post-office would be the analogues of my speech centers when I am reading aloud to somebody. First, my eye or reading center, would then be telephoning to my uttering center, to send its word to my ears, for them to judge whether my eye center and my uttering center were each doing their business correctly. Now, the telephone might go wrong from a damage to it in my own house, or from a break in the wire between it and the central office, or from an injury to the telephone receiver there. Thus, we have three kinds of telephone aphasia to begin with. Or, telephone connections being all right, there might be just the same three kinds of derangements in the telegraph part of the circuit; or, lastly, telephone and telegraph being correct, three like mishaps might occur at the post-office, making now nine distinct kinds of derangements of connection. But if they are all to work in succession, with return messages between them, there may be three times nine, or twenty-seven, different possibilities of mishap. Nevertheless, and here is the point, if only *a single mishap* among all the possible mishaps occurred, a careful investigation could finally locate it. But, suppose a San Francisco earthquake broke all telephone wires in the place, wholly destroyed the post-office, and left only one telegraph wire in operation to Oakland, how much particular localization of the respective offices of these means of communication could be identified in the upturned town? Yet, that is about what Marie attempts in the majority of cases which he reports of aphasia after apoplectic lesions, which had wrecked not only speech centers, but had damaged the whole cortical motor areas, in addition to the ascending parietal kinesthetic areas, and ripped up no one knows what else between them all.

My three definitely located cases of aphasia are briefly as follows:

First, a man was brought to my clinic who in a drunken row had his left eye poked at with the sharp tip of an umbrella, which, however, instead of injuring his eye, passed over the eyeball and penetrated into his brain through the thin plate in the bony orbit on which Broca's convolution lies. He at once lost all power of speech utterance and, as far as I know, did not regain it afterward. He, however, could read well and understand every word through his ears, so that, as I was describing his case to my class, he saw a student with an umbrella in his hand, and pointing to it, he burst into tears. Now in this case there

was no antecedent disease, and the umbrella tip could not have gone anywhere else than just there, occasioning but little hemorrhage or other damage.

The second case was that of a lady, who, without antecedent warning, was astonished to find herself one morning as totally illiterate as a Papuan savage, because she could not read one word in writing nor a newspaper or book. When I arrived she spoke to me as fluently as any educated woman, and she heard words as well as ever, but until her death two years afterward she never saw a word. I found, on careful examination, no other vision defect, no other sensory symptom, and absolutely no motor symptom. She had word-blindness and nothing else.

The third case was that of a gentleman, aged seventy-six years, who for seven years had complete word-blindness, along with total inability to utter a word. He came for an opinion from me whether he was competent to make a will. He had had his stroke of apoplexy seven years before, but without the least accompanying sign of hemiplegia; but for all these seven years, though he could not read nor write a word, he could read and write arithmetic figures, and by them he had conducted a large business, showing me a memorandum book covered in his own handwriting with records of complicated monetary transactions. No one who had dealings with him had any doubt about his mental capacity. Now, the arithmetic center is as much a speech center as any other, and he shows that it must have its own definite locality; also, his case proves that if there be no accompanying hemiplegia, then, whether in a motor or in a sensory aphasia, no mental defect may necessarily occur.

One of the common defects of speech is that to which the term "paraphasia" has been given. In the slighter degrees of this derangement the patient uses words different from those which he intended; at this stage he recognizes the difficulty himself and at once corrects it. There can be no doubt that the derangement here is in the subcortical or association fibers, and it is still in that situation when his trouble becomes so far advanced that his talk is unintelligible from his constant use of inappropriate words. Ordinarily speech itself is automatic, since we do not pay attention to each word as we would when we imperfectly know a foreign language; likewise paraphasia may become so pronounced that the patient's talk becomes wholly confused. This is analogous to the play of the fingers on the keys of the piano by a practised musician, who does not consciously note each stroke which he makes. Similarly, the motor speech mechanisms in the brain

are called into play without attention being given to each word as it is articulated.

As it is by the association fibers that the different elements in speech are properly co-ordinated, so a lesion of these fibers may easily produce paraphasia instead of true aphasia.

Other specific derangements of speech may occur in which whole classes of words are lost. A man once came to my clinic who could not utter a word, though he could understand whatever was spoken to him; on examination, I concluded that his trouble was due to the pressure of a syphilitic gumma on his motor speech center. On having him removed from the room, so that he could not hear what I said, I told the class that we would cure his difficulty of speech by iodid of potassium, and that he would recover his speech in the following order: first, he would get his pronouns, then his verbs, and last of all his nouns. Accordingly, on the following Friday clinic he was able to use his pronouns and also his verbs, but not yet his nouns. Then, showing him a pen, he answered, "you write with," and a knife, "you cut with." The following week he had recovered all his nouns. I then told the class that during his difficulty he could use words under emotion and even sing them, whereupon he interrupted me by saying, "yes, professor, when I could not speak I still could 'cuss' like the devil, and could sing 'Rally Round the Flag Boys.'" The reasons were that verbs are subjectively deeper and earlier learned than nouns. It is we who hear or see or feel before we know what it is we hear or see or feel. Nouns, therefore, are names given to objects outside of us, and are hence last learned and the first to be forgotten, as is familiarly the case with proper names.

A child who has learned to speak may become aphasic by an embolus reaching his brain from a growth on a heart valve. Many cases of the kind have been reported in which the children afterward learned to speak by teaching the corresponding centers of the other hemisphere. One case is reported where, after injury had occurred in one hemisphere, a similar injury occurred in the corresponding hemisphere, with the result of permanent aphasia. In adults, however, such vascular lesions usually happen only after middle life, when the speech layers are no longer teachable. In some cases, by beginning to learn as they would in childhood, by constant repetition of familiar words, some ability to speak has been recovered. It is curious that in sight aphasia the letters of a printed word are sooner learned than the words themselves, so that they have to spell the words first before they can pronounce them. In many cases the derangement is evidently

functional and not organic, or the patients may remain aphasic for only a week, and then gradually recover their powers of speech.

INFLAMMATION OF THE BRAIN (ENCEPHALITIS)

Encephalitis, or inflammation of the brain substance, is usually difficult of diagnosis as such. It is often traumatic and following upon puncture of the skull, which then injures the membranes and particularly the dura mater. It also occurs in severe infections, which may produce cerebral inflammations, just as they produce localized inflammations in other organs. In such cases the symptoms may not be localizing or focal, so that they have often been mistaken for typhoid fever. The commonest cause of encephalitis is from extension of cerebrospinal inflammation, particularly when exudations at the base of the brain involve the organs of the special senses. In my own experience, a common cause is from sunstroke, when the resulting symptoms may be chronic.

Treatment.—The treatment in such cases is similar to that of inflammations following the course of the specific fevers, unless definitely focal symptoms can be recognized. In one case of my own the symptoms during life were those of a furious mania, which in a few days terminated in death.

HYDROCEPHALUS

The appearance of a child with chronic hydrocephalus is unmistakable. Rising above the small face is a greatly expanded skull in all directions, but especially in the frontal region, which may bulge over the face, sometimes with protrusion of the eyeballs. The natural sutures of the skull are all separated, and the fontanelles widened in every direction. All these features are due to accumulation of a drop-sical fluid in the lateral ventricles, the mechanism of which is obscure, occurring from below upward. The cortex of the cerebrum is, therefore, spread out, and all its numerous folds or sulci obliterated. In typical cases of this kind the disease is not only congenital, but frequently prenatal, belonging, therefore, to defect in development, of which we have no explanation.

The clinical symptoms are plainly due to the mechanical effect of the drop-sical accumulation. In some children the intelligence seems to be nearly normal, but the rule is that they soon succumb to complications caused by mechanical interference of the growth of the body.

Another form of hydrocephalus is called acquired, to distinguish it from the congenital. This form may develop later in life, and is

usually caused by the presence or growth of a tumor situated ordinarily in the third ventricle. As we have remarked in speaking of brain tumors, these cases are accompanied by headaches and other signs of intracranial pressure, producing optic neuritis and blindness. The real condition of the patient may not be diagnosed during life, but after death the ventricles are found greatly distended from pressure upon the local veins, which are sometimes much dilated.

Treatment.—We have no proper treatment for this condition. Attempts have been made to reduce the intercranial effusion by lumbar puncture so as to tap the cerebrospinal canal, but so far nothing but disastrous results have followed this operation.

BRAIN TUMORS

Intercranial or other brain tumors have certain clinical features which are very characteristic. These are: first, headache, which may be either frontal or occipital; second, vomiting; and, lastly, choked disk, which is due to an edema of the optic nerve. These signs when taken together almost certainly tell of brain tumors, but they do not indicate the nature of the tumors nor their locations. The situation may be all important because of the great advance made in recent years in the surgery of the brain.

Masses of tubercles may form actual tumors in the brain, usually secondary to tuberculosis elsewhere, but sometimes found only in the brain substance, chiefly in children or in young subjects. Syphiloma may also develop in the cortex or at the base of the brain about the pons. Glioma is one of the most common tumor formations of the brain. It may be hard, almost like an area of sclerosis, and not sharply defined from the surrounding brain substance. Developing in the neighborhood of the pituitary body, it is very likely to produce blindness from optic neuritis. Gliomatous tumors may be quite vascular and produce local hemorrhages.

Brain tumors are of varied nature, some of them being true fibrosarcomata, and, developing in the cortex, may give rise to decided focal symptoms, which will greatly aid in their topical diagnosis, and thus assist the surgeon when operating for their removal.

Cancerous tumors of the brain are always secondary to cancer elsewhere, particularly about the cecum or colon. In some cases of cerebral tumors a spot tender to pressure may be found on the skull. Bony outgrowths from the falx may also occur, one of which was nearly one inch in length in a patient of mine who died from convulsions. Fibroid tumors may also develop from the dura. Cystic formations

may sometimes be found as a result, usually, of injuries, producing subdural hemorrhage.

We have already alluded to that variety of sarcomatous tumors called psammoma, in which after death the brain is found simply infiltrated with gritty particles of carbonate of lime.

Brain tumors often produce true focal symptoms, which have enabled surgeons to perform some of their most noted operations.

Syphilitic tumors of the brain cannot be diagnosed apart from the manifestation of syphilis elsewhere, but when a patient shows the signs of brain tumors, such as headache and optic neuritis, a free course of potassium iodid may be hoped to remove all the symptoms.

ABSCESS OF THE BRAIN

The symptoms of abscess of the brain may be very suggestive of the presence of this lesion, or they may be the most obscure of any brain symptoms. I can hardly forgive myself for being misled by the statements of the attending physician who ascribed the obstinate taciturnity of a young lady to hysteria, as he told me that she had often before been very hysterical. Besides myself, an eminent consultant had been called in, who fully agreed with the diagnosis of hysteria. While we all three were yet in the house the patient suddenly died. I then, for the first time, learned that she had been subject to chronic otitis media, and that the discharge from her ear had ceased for over a month.

There is no cause of brain abscess so common as chronic otitis. Next in frequency are suppurative conditions of the mastoid cells, as most cases of these are preceded by otitis. It should be remembered that in the upper part of the cavity of the tympanum is the thinnest bone in the body, itself not much larger than the surface of a split pea. On the brain aspect of this thin piece of bone there is usually a good-sized vein which communicates with the lateral sinus. Inflammations of the middle ear, therefore, may excite a septic thrombosis of this vein, which soon involves the contiguous structures, and affords an explanation of the penetration into the brain substance of septic organisms with the attendant formation of a brain abscess in the temporal lobe. The symptoms of such an abscess may then be severe headache, with signs according to the acute or chronic development of the abscess. The abscess does not often produce optic neuritis, and thus differs from brain tumors. Instead, there is fever or a very suspicious symptom, which is an irregular and intermittent pulse. In every case presenting such symptoms the condition of the ear should be

carefully investigated, particularly as in modern times it is well known that the brain can be examined by surgical procedures with impunity.

NEUROMATA

These are tumors forming upon nerves in their course, and are generally due to congenital faults in development. Some of these tumors resemble gliomata in their structure, but others contain true nerve-fibers, and a few have actual ganglionic cells. In other cases they resemble plexuses. Neuromata sometimes occur in great numbers on the surface of the body, and can be easily felt under the skin. Occasionally they involve sensory nerves, so as to become quite painful, requiring surgical removal. We should clearly distinguish from neuromata the formation of bulbous outgrowths at the ends of nerves in amputations. These are usually very painful, but the patients refer the pain to the ends of the amputated limbs. I knew of a case who couldn't be persuaded that his amputated leg was not before him on the carpet, due to the fact that all injuries to a nerve in its course in health are referred always to the periphery; as when the funny bone is struck at the elbow, the pain is not felt there at the point of injury, but at the ends of the ulnar nerves in the fingers.

The only **treatment** for such cases is to dissect up the implicated nerve bulb involved in the amputation, removing it from the retracted flap.

CHAPTER XXI

DISEASES OF MUSCLES

INTRODUCTION

Of all the chief textures of the body, the muscles are the least likely to be the seat of special disease. This is remarkable when we consider the great importance of the muscular tissues in their relations to life. Thus, as we have remarked in diabetes mellitus, the muscles, besides their other functions, are the true furnaces of the body, as it is in them chiefly that the carbohydrates, whether starches or fats, are literally burned up, ending in carbonic acid, like any stick of wood or other combustible article. This heating function of the muscles is altogether independent of their contraction and relaxation by which all bodily movements are executed, for the muscles generate heat while they are at perfect rest. It is fortunate for us, therefore, that of all the important tissues of the body, true muscular disease is so uncommon. So intimate is the relation of all muscles to the nerves which activate them that it is difficult to treat muscular disorders without alluding to the connections of the muscles with the nervous system. But such disorders do take place in which the muscles only are involved. These diseases are purely and primarily muscular, and not due to any changes in the cerebrospinal axis, the muscles presenting no fibrillary twitchings, but simply wasting away, with sometimes deposits of fat taking place between the atrophied muscle bundles. This fatty increase may so mask the muscular wasting, especially in the calves of the legs, as to cause those parts to be apparently hypertrophied. In other cases there is no deposit of fat, but, instead, all true muscular structure disappears.

These muscular affections vary in their symptoms according to the groups of muscles implicated. They are, as a rule, unaccompanied with any sensory disturbances, and in the great majority of cases are due to hereditary defects in muscular growth; these affections occurring, on that account, in families as part of the congenital structural development of the muscular system.

MYOSITIS

Of these disorders, we have myositis, or inflammation of muscles proper, reported only from a corner of Japan, which is ascribed to bac-

terial infection causing actual suppuration, the agents of which are the familiar *Staphylococcus pyogenes* and the *Streptococcus pyogenes*. Sometimes infection occurs from the skin and proceeds inward, and is then called dermatomyositis.

MYOTONIA, OR THOMSEN'S DISEASE

Another uncommon affection is called myotonia, or Thomsen's disease, rare in every country except Germany and Scandinavia. In this complaint the spinal cord and its nerves are intact, but the voluntary muscles show a peculiar stiffness, particularly at the beginning of a muscular act. This disease begins in very early life, and is restricted to the few families in which it occurs as a hereditary trouble.

MYASTHENIA GRAVIS

In this affection the spinal cord and nerves are found intact, but all the voluntary muscles are soon fatigued instead of being paralyzed. That they are not paralyzed is shown by their temporary recovery or power after rest. It is, however, a grave complaint, for, of the recorded cases, it proved fatal in about 45 per cent. In some cases the affection is temporary, patients recovering and living to old age.

Treatment, therefore, should not be omitted, and consists of massage, faradism stopping short of fatigue, the use of strychnin, and the iodids.

FRIEDREICH'S DISEASE

Friedreich's disease is usually, but not always, a hereditary complaint, characterized by symptoms not unlike those of tabes dorsalis, but differing altogether from that complaint in respects of the age and the characters of the muscular inco-ordination. Thus, in Griffith's 143 cases the majority were in the early period of life, all except 5 occurring before the twentieth year, 15 occurring before they were two years old.

As to symptoms the inco-ordination resembles sometimes that of a drunken man, and not the stamping walk of the tabetic, and very marked ataxia occurs early, in distinction from tabes in the arms. The movements of the affected limbs are so irregular that they even resemble chorea. It differs from chorea, however, in that the hand seems to hover over the object aimed at and suddenly pounces upon it. There are also irregular movements of the head and body.

The deep reflexes are early lost, the skin reflexes are normal and so are those of the pupils, but there is pronounced nystagmus. The

speech is also affected and is scanning in character. Sensory derangements are rarely present.

The feet become early distorted and talipes equinus is common, the big toe is flexed, and scoliosis or distortion of the spine is often present.

Morbid anatomy shows disease of the posterior columns, as in tabes, but evidently of different origin, because the neuroglia are implicated, as if the affection were really a gliosis, involving especially the cerebellar tract, thus explaining the irregular movements.

There is a cerebellar type of this disease which is markedly hereditary, but which starts later in life, after the age of twenty. In this case the knee-jerks are retained and a spastic condition of the legs ultimately develops. The cerebellum has been found atrophied in 2 cases.

Friedreich's disease is practically incurable, and as it advances complete paralysis may come on.

MYALGIA

A word may be said here about a very common complaint, myalgia, which means pains referred to the tendinous attachments of weakened muscles; in fact, indicative simply of muscular overstrain. Thus, it is quite common among women to complain of pain along the attachments of the abdominal muscles to the lower ribs. Other cases have aching pain at the nape of the neck, due to the inability of the weakened spinal muscles to bear the weight of the head. Many of these cases suffer from pain in the eyes. Other cases are characterized by aches and pains along the whole spinal column, all due to the overtaking of the debilitated muscles that maintain the body in its erect posture. The spinal muscles, in fact, may be so weakened and aching that the spinal column becomes distorted, usually between the shoulders, from the habit of patients throwing the weight in standing on the right leg. The processes of the vertebræ may, therefore, become tender to touch. This disease should never be considered in any way inflammatory, no matter how much the pains may be complained of.

Treatment.—The proper treatment is by repeated rest, the patient remaining recumbent for an hour or so, and then rising, while cold sponging to the spine, followed by friction, should be performed night and morning. Rest in the open air, lying down in a hammock, is to be advised, on the principle that nothing so strengthens muscles as a free supply of oxygen, while all means for improving general nutrition should be systematically observed.

Equal parts of cologne and vinegar, applied warm to the aching parts, are very effective.

CHAPTER XXII

MALIGNANT DISEASES

INTRODUCTION TO THE STUDY OF NEW GROWTHS

THERE is no more remarkable organization in the world than a healthy human body. Every part in it takes its own proper place for the purpose of mutual well being. Neither cell nor tissue exists for its own sake, but rather for the benefit of the entire organism. Not only can the hand say to the foot, "I have no need of thee," but everything in the body exists for the purpose of ministering to the advantage of the rest. Meantime the cells of every tissue of the body have the property of growth and of multiplication. This is shown by small cutaneous grafts when implanted on a non-healing ulcerated surface of the skin. These grafts begin to grow in all directions, their cells making the true skin until they meet the edges of healthy skin, when they at once cease to proceed further.

One peculiarity in these growing cells, as they form new skin, is that before reaching the borders of healthy tissue the latter begins to throw out growths to meet the approaching cells of the new skin. This seems to indicate that an invisible influence is at work to direct the new-growing cells, a fact which is not without its bearing upon all healthy nutrition, and it may be the absence of this influence which will explain some of the features of malignant growths. If they did proceed further, they would then become new growths. There is, therefore, no room in the body for anything really new. A tumor, even if only a small wart, is out of place, a truth illustrated by the fact that warts, and particularly moles, are often the beginnings of very injurious or so-called malignant growths, so much so that many surgeons recommend that every wart should be removed by total excision.

New growths, therefore, are always to be regarded as entirely out of place, and pathologists all over the world are diligently investigating the causes of them. Their reasons for so doing are that no one can tell at what time or turn a really new growth may not be the beginning of the end in a terrible death. This happens when a new growth takes on the characters called malignant. These growths, instead of ministering in any way to the general well-being of the body, are dis-

tinctly injurious from the start. Thus, instead of behaving with a strict regard to the rights of its neighbors, a malignant sarcoma, for example, grows quite independently, invading its neighbors so rapidly that it destroys them by its own unchecked multiplication. Some sarcomata simply play havoc wherever they spread, and may extend along the lymphatics, to set up new centers of development having all the evil characters of the growth from which they started. Another serious feature in them is that they often seem to secrete poisons which devitalize and destroy the healthy tissues they invade, including the blood. I had a patient some sixty years of age who was remarkable for his good looks. He began to complain of a localized pain in his sacrum. At once he showed loss of color, and soon after a progressive loss of flesh. In the course of eighteen months he was a mere shadow of his former self, and yet not at all from lack of food, for he never lost his appetite, and apparently digested well whatever he took. When he died I made a necropsy, and found only a small cancerous tumor in his prostate, with a few enlarged lymphatic glands leading from it, and another small secondary tumor involving the root of the first anterior sacral nerve, which explained his pain. Above this were a few cancerous nodules in his liver, but altogether these new growths did not weigh an ounce, and yet were sufficient to make him appear as if he were stricken by some cruel fiend.

The evil effects of malignant growths, where they attain any size, are illustrated by the term "cancerous cachexia," by which is meant a systemic decline in health marked by special characteristic features.

Though originally so difficult to account for, tumors may be of widely different characters. Some of them seem to be simple overgrowths of the tissues in which they develop. Such are the so-called myomata, which are made up chiefly of healthy normal muscle tissues. These are frequent in the body of the uterus, and may occasion no inconvenience nor tendency to shorten life. To this class the term "benign" has been given, meaning that they show no tendency to infiltrate neighboring tissues, but, at most, simply to displace them. Malignant tumors, on the other hand, are characterized by their independence of all check or rule. To this independence the technical term "anaplasia" has been given. Thus, all cancers and sarcomata are virtually like parasites, which, invading the body, then grow as they please, and reproduce themselves precisely as they began, without any reference to the advantage of the organism.

Unfortunately, there seems to be no limit to the development of malignant growths in the vertebrate animal kingdom. Wild animals

in the state of nature, and domesticated animals, whether cattle, horses, swine, or even fishes, develop cancer as well as man.

The only encouraging feature is that these growths generally begin as purely local developments, so that if they can be entirely removed at this stage they do not return. Thus, one of the most serious of them is cancer of the stomach, but it has been frequently shown that if gastric cancer can only be recognized in time, the surgeon can excise it and thus effect a permanent cure.

In such cases, however, it is not the tumor that is cured, but the patient.

One of the worst features of specifically malignant new growths is their tendency to metastasis, by which term is meant that the specific germs of the disease are detached from the new growth itself, and carried either by the lymphatics or by the blood to distant localities, where they grow again with all their special features down to the smallest anatomic details. Thus, a carcinoma in the rectum may be the source of a secondary tumor in the brain, which, if examined, is found to consist of the special squamous cells which line the mucous membrane of the descending colon. To this important feature of malignant growth the term "autositic" has been given. It is one of the evidences of the essentially foreign origin of malignant growths that whenever such tumors are found in the body the question at once arises as to the location of the primary seat of the invader.

The property of giving rise to metastasis does not belong to all malignant growths. Thus, there are certain tumors which may infiltrate the surrounding tissues, and which, if they reach the skin, ulcerate and fungate, sometimes forming masses of considerable size, but which do not give rise to secondary growths in distant glands or in distant organs. Rodent ulcer, for example, among the epithelial tumors, belongs to this group.

Malignant tumors are usually divided into two classes—carcinomata or cancers, which spring from epithelial tissues; and sarcomata, which spring from connective tissue.

In the case of carcinomata, particularly, the presence of a cancerous deposit leads to an increase of connective tissue about it, which is usually very firm, and in cancer of the breast forms a hard lump, to which the term "scirrhus" has been given.

Malignant tumors, whether slow or rapid in their growth, appear to have a limited vitality compared to the cells of normal tissue, and, therefore, in time break down and form large ulcers. The secretion of these ulcers often has a very offensive odor, as if due to actual

necrosis or death of the tissue. The modes of this degeneration are quite various in different cases. In the stomach, for example, there is a frequent tendency to what is called colloid degeneration. I have known of a case in which the stomach was more than half-filled by what appeared to be a tumor of simple colloid, without any cancerous element apparent. In a sense, however, the term "colloid" is a misnomer, for the substance has no resemblance to true colloid, as it is found in the cells of the thyroid gland, and, instead, seems to be a modification of the mucin secreted by a mucous membrane. Hence, it is not uncommon to find the same kind of degeneration occurring in cancers of the intestinal tract.

The second, and perhaps more common form of degeneration, is fatty metamorphosis, which is itself a natural termination of imperfect growth. In such cases the true cancer cells may be found only at the periphery of the growth.

Another degeneration is that in which the tissue is transformed into a mucin-like body. This is particularly common in some forms of sarcoma, so that they are called myosarcomata.

Hyalin degeneration is another form, called so from its appearance, being a homogeneous, structureless substance characterizing the whole tumor, or found scattered only here and there through its substance.

Lastly, there is a fibroid change which in places gives rise to deposits of lime salts. It is curious that these may at times resemble the structure of bones, and in some metastases actual formation of bony tissue may occur.

Theories as to the origin and nature of malignant growths are numerous, but none of them has as yet been generally accepted among pathologists. Among them is Cohnheim's theory, which virtually is, that at certain times during the development of the embryo some cells become detached from the parent organism, and then may rest in the body, not to develop into new growths perhaps for years. This ingenious theory, however, lacks the facts which would demonstrate it, and, therefore, is now generally discredited. A more probable supposition is that of Ribbert, who postulates something like an antecedent inflammatory process, occurring in what he calls the precancerous stage. This process lifts, as it were, a set of cells from their previous attachment and sets them free, to live an independent existence. There can be no doubt that the theory of a precancerous stage has something to recommend it, but, if so, it should give some sign of its presence in the very earliest steps of a malignant growth, which is by no means the case.

A very general view held at present is that the cells of a malignant growth are simple modifications of normal cells which have taken on malignant properties by as yet unknown processes. The chief arguments for this view are that malignant growths often develop in tissues where, at the beginning, it is difficult to show in what respects they differ at all from the normal tissues in which they are found. This view was naturally suggested by the failure to find any unmistakable parasitic organism to which they could be ascribed, such as we find as the specific causes of the majority of infectious agents, as, for example, the tubercle bacillus. My own view is that the characteristic cell, whether of a carcinoma or sarcoma, is itself a parasite, and contains all the properties of a true parasite. How it originates is yet unknown, but that it is a modification of any normal cell is to me improbable. The chief argument that it is not a foreign parasitic organism is that in nearly all cases of true parasites they are specific. Thus, the bacillus of typhoid fever can grow only in a human body, but against this the tubercle bacilli can grow in the bodies of not only the warm-blooded, but also in the cold-blooded, animals. On the other hand, experiments have shown that malignant tumors may be transferred from one mouse to the other, and even be sent by mail, as Jensen did from Copenhagen to London, although such growths cannot be transferred except to animals of the same species. One hopeful result of these experiments was that, although cancer cells might be transferred to rats from mice, yet in the rat the growths soon aborted, and that after a rat recovered he became immune to any further implantation of cancer from mice.

A more probable clue to the origin of malignant growths is found in the investigations of the development and changes that occur in the nuclei of living cells. It is now generally admitted that the nucleus is the most living part of a cell. It shows a most complicated arrangement of its constituent particles, and that it is in the nucleus that all hereditary potencies are contained. In normal growth the nucleus begins by dividing into two symmetric halves, which contain a definite number of special constituents called chromosomes, and named according to their shapes and destinations. Each of the two daughter-cells which follows upon the division of the nucleus should contain exactly the same number and kind as those of the parent cell, but it has been found that the cells of malignant growths do not conform to this rule, because one daughter-cell will contain more than it should, while its fellow contains less than it should. It is probable, therefore, that this disorder in growth starts from the very beginning of cell life.

CANCER OF THE ESOPHAGUS

This growth necessarily produces stricture and difficulty in swallowing, first, any solid food, and afterward, equally so, any liquid food. Its presence may be readily determined by passing an esophageal bougie. I was once consulted by a physician who said that he passed such a bougie and that it was arrested at a definite point. As the patient was over sixty years old, he made a diagnosis of cancerous stricture of the esophagus. On examining him myself, I soon became convinced that the esophagus was pressed upon by an outside tumor, and further examination showed that he had numerous tumors elsewhere, both in the neck and in the liver, which proved to be the glandular enlargements of Hodgkin's disease. When due to cancer, it is in the form of an epithelioma, and in its course may invade the trachea or some large bronchus, when it occasions persistent cough. If situated in the lower part of the esophagus, this tube may become dilated above the stricture so as to retain the food a good while after it is swallowed, until it is brought up by a reverse action of the tube.

CANCER OF THE STOMACH

Recent statistics seem to prove that cancer of the stomach is only second in frequency to cancer of the uterus. It is more common in males than in females. As to age, Welch gives, out of 150 cases, three-fourths occurring between the fortieth and the seventieth years. The prevalent conception that this disease is hereditary is a mistake; it bears no comparison with tuberculosis in this respect. As to previous disorders disposing to cancer, the statistics of the Mayo Clinic are decisive. They state that nearly 75 per cent. of gastric cancers originate in chronic gastric ulcers.

Morbid Anatomy.—The most common varieties of gastric cancer are the cylindric-celled adenocarcinoma, the encephaloid or medullary carcinoma, the scirrhus, and, lastly, colloid cancer. As to situation, the pyloric region is invaded in more than 50 per cent.; in the lesser curvature, in about 15 per cent.; at the cardia, in 10 per cent.; on the posterior wall, in 8 per cent., and in about the same percentage involving the whole stomach, while only about 5 per cent. occur in the fundus.

The medullary cancer occurs in soft masses which involve all the coats of the stomach and usually ulcerate early, with effusion of blood. The cylindric-celled epithelioma may form a large irregular tumor, with somewhat firm consistence. The scirrhus variety is characterized by great hardness, due to the abundance of stroma. It is found most frequently at the pylorus, where it is a common cause of stenosis, and

may be secondary to cancer of the ovaries. Not infrequently there is simultaneous involvement of the small and large intestines. The colloid cancer we have already referred to. It involves all the coats of the stomach, and is prone to spread to other organs. Cancer of the stomach is often secondary to cancer of the breast.

Changes in the Stomach.—Cancer at the cardia is usually associated with wasting of the organ and reduction of its size. On the other hand, annular cancer, at the pylorus, causes stenosis with great dilatation. In diffuse scirrhus cancer the stomach may be greatly thickened and contracted, when it may be displaced or altered in shape by the weight of the tumor, particularly in cancer of the pylorus, when it may cause difficulty in diagnosis, for its mobility is such that it may be found anywhere in the abdomen, even down in the true pelvis. It is, however, often retained in a particular region by the formation of adhesions.

As might be inferred, secondary cancerous growths are very common. Besides developing in various organs, notably the liver, the lymphatic glands are frequently affected. When the cervical and inguinal canals are involved, they may serve to give a clue to the diagnosis, and likewise when they occur under the skin, particularly about the navel.

The further progress of this fell disease may cause all kinds of complications, such as perforation into the peritoneum or into different parts of the intestines, or into the pleura, the lung, or even into the pericardium.

Symptoms.—Sometimes there are no symptoms pointing to the stomach, and the tumor is found unexpectedly after death. In other cases the symptoms are not gastric, but point to the liver or some other organ. Occasionally, in elderly persons, there is gradual asthenia, without nausea or vomiting.

In many cases the history of the onset was sudden. As to general symptoms, progressive emaciation is one of the most constant, and in some cases the loss of weight, without assignable cause, constitutes the most ominous symptom of the case. Usually with this is persistent loss of appetite, and, finally, vomiting. This may set in early, and then persist with such violence as to cause a fatal termination in a few weeks. Vomiting is more common when cancer involves the pylorus, though it may then be delayed for more than an hour after taking food. When the cardiac orifice is involved, it may follow very soon after eating.

We have already mentioned that cancer of the stomach in its earliest stages may be excised with permanent cure of the patient. If that

be a fact, its early diagnosis is of great importance, but this is often a matter of great difficulty. If a patient, after middle life, has hitherto enjoyed excellent digestion, the advent of disordered digestion should always be regarded with suspicion.

In all cases of suspected gastric cancer a careful examination of the contents of the stomach, either vomited or removed by the stomach-tube, ought to be carefully made. One of the most important indications comes from absence of hydrochloric acid. This may occur in other chronic diseases of the stomach, such as in achylia gastrica or in very chronic gastritis, but in neither of these conditions is it so characteristic as in gastric cancer, and is evidently due to a specific influence of the disease. At one time I thought that it might occur in cancer of other organs than the stomach, but my observations are not numerous enough to prove this, though, so far as they go, they render it highly probable.

Hematemesis, or vomiting of blood, occurs in nearly 30 per cent. of all cases of gastric cancer. Rarely the blood is bright when it comes from a recently formed ulcer, but in cancer of the pylorus the vomited blood is usually dark colored, and when mixed with other ingredients is often called "coffee-ground" hematemesis. It is not so profuse as it sometimes is in gastric ulcer, but, as in that complaint, it may occur as the first symptom.

Another of the first symptoms of cancer is a tumor, usually first noted about the epigastrium. Being in the stomach, it is not affected by the movements of respiration, but when detected the valuable sign in all abdominal growths is to find what part of it has no free border.

Of the purely clinical symptoms, one of the chief is the existence of pain. Pain is a very important symptom, but it is remarkable how often it is entirely absent. When present it is not paroxysmal, but may be referred to distant parts, such as the shoulders or in either hypochondrium. As a rule, it is what may be called a "wearing" sensation, but may be boring. Its chief feature, however, is its persistence, and may or may not be aggravated by taking food. It is not often relieved by vomiting.

CANCER OF THE INTESTINAL TRACT

After noting the characters of malignant disease of the stomach, it becomes evident that cancer may occur in any part of the body, a fact fully illustrated in the development of cancer along the intestinal canal. Thus, it may occur in the duodenum, and is then very commonly associated with persistent jaundice. It is of comparatively rare devel-

opment in the small intestine until we approach the region of the cecum, where it is relatively common. Cancers of the intestine are columnar celled, in contrast to those of the esophagus and skin, which are squamous celled.

When cancer develops about the cecum it is prone to form metastases, particularly in the liver and in the lung. It is from this source also that the commonest metastases in the brain occur. All such malignant growths in the intestine produce their characteristic symptoms according to which part is involved, because in most cases they produce constriction or stenosis of the tube. If the location is not far from the rectum, deceptive tumors may develop from simple accumulation of the feces above the stricture. Cancer of the rectum, in fact, is one of the common sites of this invasion, and should be detected early, because its removal by surgical operation may then be feasible. Its earliest symptom is usually pain in the act of defecation, and then, as it proceeds, the movements have a peculiarly thin, drawn-out or ribbon-like appearance. An early examination by the finger should then be made, when the tumor may be readily detected. Higher up the symptoms are usually those of colicky pains, when constitutional signs, such as emaciation and cachexia, may indicate how serious the trouble is.

CANCER OF THE LIVER

Primary cancer of the liver is so uncommon that it should lead us to search for a focus elsewhere in the organ or in the neighboring tissues for that to which the liver cancer is secondary. Thus, cancer of the gall-bladder and of the biliary passages is a common result of chronic irritation by gall-stones. It is also not uncommon for it to be secondary to cancerous stricture of the pylorus, but, whatever the source, the soft tissue of the liver seems to favor great development of large cancerous tumors in the substance of the organ. On that account cancer of the liver is commonly painless, and only when it is developing where its growth may implicate the bile-ducts is jaundice present, except, as already mentioned, when the disease begins in the duodenum. I have known the liver to be greatly enlarged on account of its contained cancerous tumors, without either pain or jaundice. On the other hand, a coexistence of ascites with jaundice is very suspicious. When the liver is the seat of cancerous tumors they are usually quite palpable on examination, often discoverable as rounded projections on the surface of the liver or along its edges. Little doubt also of their being hepatic can occur, when they are plainly depressed by the descent of the diaphragm in breathing. The prognosis of liver

cancer is invariably bad, emaciation and cachexia attending its course early, and the patients rarely surviving the first year of the complaint.

Cancers elsewhere in the abdomen, whether in the pancreas or in the adrenal bodies, are pretty sure to indicate their presence by the changes in the functions of those organs.

CANCER OF THE BREAST

There is no subject which causes such anxiety, both for the patient and the physician, as the presence or not of cancerous disease in the sexual organs of women, whether of the uterus or of the breast. With reference to the uterus suspicion rarely occurs except in the reappearance of menstruation after it has normally subsided with advancing years. In such cases the reappearance of the bloody flow after menstruation has ceased for several years does not mean a return of menstruation, but is always due to some organic change in the uterus itself, very often the advent of cancer in the organ. In other cases suspicion is aroused by what is at first too great and prolonged a flow of blood at what is supposed to be the time of the menopause. Examination then should be made, because modern surgery has shown that the whole uterus can be removed and little danger to life occasioned, so that, instead of succumbing to uterine cancer, the patients may live for years in good health.

The first signs of cancer of the breast should, for the same reasons, be well determined. It is not enough for such purposes to find a tumor in the substance of the breast, for such growths are often quite innocent.

It is otherwise if, with signs of hardening within the gland, the nipple is retracted or quite distorted when compared with its fellow in the other breast. If, in addition, the skin is not easily movable over the tumor, and dilated veins seem to radiate from the nipple outward, the axilla should be carefully examined to note whether there are any enlarged glands in it. If one or more of these signs are present, no time should be lost in amputating the breast. At present such operations are notably successful, because surgeons now are not content with removing only the breast, but make sweeping incisions to insure the cutting away of all possibly implicated lymphatic glands in the axilla.

CANCER OF THE LUNG

The symptoms of cancerous disease of the lungs differ according to whether the disease is primary or secondary. If secondary, we have every reason to suspect that the pulmonary symptoms simply

indicate extension from a known cancerous focus elsewhere. Then the symptoms may be extremely varied, according to the situation of the secondary growths. Primary cancer of the lung, on the other hand, may for a long time be obscure in its signs. It occurs more frequently in men than in women, and a common first symptom is rapid breathing without any assignable cause. These primary tumors are often large, and then the symptoms will depend upon what extrapulmonary tissues are involved. If there is any pressure upon the trachea or upon a large bronchus, cough is certain to develop. If the patient survives for any length of time, the veins on the surface of the chest may be very prominent and dilated, and then secondary glandular enlargements occur, more commonly visible just above the clavicle. Primary cancerous deposits may first develop in the pleura, and give all the symptoms of generalized pleurisy, with or without any effusion. In them, however, it is peculiar to find the ribs very tender on pressure, which is explained by the involvement of the bones in the cancerous process. One peculiarity I have noticed in these patients is a remarkable diminution in the percentage of urea in the urine.

No civilized country in the world is at present without institutions or special laboratories for cancer research, but it has to be admitted that we seem to be as far as ever from knowing what cancer or sarcoma really is. Experimental research has, therefore, been widely attempted in the direction of transplanting or inoculating animals with cancerous material. It was soon found, however, that such experiments were always unsuccessful if attempted with animals of different species. Thus, portions of cancerous tumors from a human subject can never be transplanted to any other animal. On the other hand, it has been found that cancerous growth sometimes occurs spontaneously in mice, and then can be transferred to other mice and grow in them. Rats, because they are allied to mice, can also be inoculated from mice, but, as we have already stated, this experiment is only partially successful, for it does not kill the rat, and even causes that animal to become immune to further inoculation.

SARCOMA

Connective tissue is necessarily the widest spread tissue in the body, because it is the tissue that binds together all the specialized tissues and organs. It is, therefore, the most primitive of all the tissues; hence, when any of the higher tissues—such as muscular, glandular, or nervous—degenerate and die, the connective tissues are ever

ready to take their places. The general tendency of such replacement is to shrink in bulk and to harden in texture, such as in cirrhosis of the lungs and of the liver. When this process occurs in nervous textures it is called sclerosis.

Now it is from these primitive and least differentiated tissues that all sarcomata are derived. Sarcomata are formed of living cells, and, therefore, show the primal property of indefinite multiplication. Where the element of simple multiplication predominates and tissue differentiation is at its lowest, the resultant growth is the most malignant in its character. A normal cell always conforms to law and is checked by law, but a malignant cell is a pure anarchist, whose further growth tends only to ruin and premature death. Thus, no cancer shows such malignant characteristics as a melanotic sarcoma, which, beginning in the choroid membrane of the eye, rapidly spreads to all parts of the body.

We have already shown that malignant tumors are deficient in vitality, and, therefore, are prone to ulcerate and to break down wherever they grow. Sarcomata, belonging to the least vital and least differentiated of tissues, show, therefore, the least tendency to form organized growths. This is well illustrated in the fact that, however vascular they seem to be and, therefore, bleed readily, these tumors do not possess real blood-vessels like many cancers do, but instead form only imperfectly developed blood-channels.

Clinically, sarcomata, instead of developing like cancers in middle or post-middle life, are often found among the young. Thus the hideous and rapidly growing sarcomata of the eye generally occur in children, but, as we have remarked, multiplication of cells is itself a great evidence of a reversion to the rapid growth of cells in embryonal tissues, and if such multiplication stops short of true organization it then assumes the worst characters of malignant growths. There is nothing, therefore, that can exceed in its unfavorable import the manner in which a multiplying focus of sarcomatous cells invades the surrounding organized tissues and destroys them. A localized cancerous tumor, as we have remarked, may develop in the walls of the stomach, and, if recognized in its early stages, may be safely excised, but it is doubtful if there be a parallel instance in sarcoma. We can never be sure that its cells have not already been disseminated far and wide in the system.

The most frequent seats of sarcoma are the connective tissue of the skin—periosteum, intermuscular septa, tendons, subserous connective tissue, and the eye.

Sarcomata assume a great variety of forms, according to the situation of the connective tissue in which they originate, and hence are named accordingly, but owing to their numerous varieties we need not enumerate them by name. One of the most singular of these forms is what is called a psammoma, which develops in the substance of the brain. I had a patient in whom, after some months of illness, there was found at autopsy thousands of such collections scattered all through the white matter of his brain, so that no incision anywhere could be made without encountering gritty particles, which proved, on examination, to be composed of carbonate of lime.

TREATMENT OF CARCINOMA AND SARCOMA

As to treatment, we have already mentioned that previous to the introduction of radium the only measure was by surgical excision of the growths. The remedial effects of radium, however, require a fuller statement of its details, for this mysterious element, radium, has already caused a revolution in the conceptions of physicists about the constitution of matter itself, suggesting that in this substance we have the spectacle of a material atom undergoing disintegration, and while doing so setting free a variety of powerful forces which could be revealed to us in no other way. Thus, it emits a number of lines of force called, respectively, alpha-, beta-, and gamma-rays. Dr. Abbe states, in his reprint on "The Use of Radium in Malignant Diseases," "After suitable exposure of seeds to varying amounts of soft and hard rays, issuing in incessant streams from this wonderworking mineral, we watch them grow and see three results: (1) A death-dealing force has played upon the nearby seeds so that their life is destroyed; (2) upon seeds a little further removed a stimulating effect has occurred, wonderful to relate, so that their growth is greater than that of seeds which have had no radium; and (3) at distances beyond that of stimulation, where the hard gamma-rays have played relentlessly upon the seed life, they show a retarded vitality, and are depressed in their growth more and more up to a point several inches away from the radium. The range of action of alpha-rays, we are told, is within $\frac{1}{2}$ inch, that of beta-rays somewhere about $1\frac{1}{2}$ inches, but the gamma-rays are ultra-penetrating.

"Judged from complete demonstrations which can be illustrated on a photograph, we have a proof that we can produce three different effects upon the cells by the correct use of radium: (1) Destruction of life; (2) stimulation; and (3) depression and retrograde change. I shall

endeavor to show that the surgeon can utilize the third so that he can at will produce that retrograde change in cells which have shown erratic overgrowth and formed life-destroying tumors. Partial success, or discouraging failures of the past, may be largely due to ignorance of the baneful influence of the alpha- and beta-rays which one can now eliminate. In this, I think, we put our finger on the weak spot in radium treatment. If the beta-rays stimulate, we certainly do not want them; it is fair to say that gamma radiation is our aim."

I have seen remarkable changes for the better in a large ulcerating cutaneous cancer by the use of radium. This occurred in a patient of mine, a lady of about seventy years of age, after the application of radium by Dr. Robert Abbe. The epithelioma had caused a very chronic ulceration of the skin for six years, until it was as extensive as the palm of a hand, with fungating edges, particularly the upper end. Dr. Abbe used the radium at intervals of seven days. The result seemed to be an advance of quite healthy skin at all the edges of the ulcer. After two months' use of radium the ulcer was diminished quite one-half in extent. To me the most striking feature about the case was the perfectly healthy and normal appearance of the new skin, which at all times could be plainly distinguished from the diseased tissue. I was, therefore, very sorry that in time the patient ceased from pursuing the treatment.

How radium acts upon malignant tumors is difficult to explain, except that, as we have already mentioned, malignant growths, though composed of living cells, are very deficient in vitality as compared with normal cells, and the gamma-ray of radium appears capable of destroying the malignant cells without affecting the normal cells. In rare cases cancerous tumors have been known to get well spontaneously, owing to the supervention of fatty degeneration.

In all his cases Dr. Abbe has taken photographs of the lesions at four periods in the treatment of cancer of the eyelids, nose, and chin, with one case of osteosarcoma of the head of the humerus, which, after apparently complete destruction of the bone, was finally cured, with restoration of the joint to its normal size. I have never seen such remarkable results in the treatment of superficial cancers, which time and again showed not only restoration of extensively ulcerated parts, but with no scars remaining. In one case, where the upper eyelid appeared eaten away, the restoration after the use of radium was so complete that no one could tell which was the lid involved.

Besides the effect of radium just described, as produced by Dr.

Abbe on malignant growths situated on the skin, and which can be explained only by the radiation of lines of force analogous to rays of light from the substance itself—whence its name, radium—lately a similar extension of effect has been produced upon internal cancer by exposing the malignant growths to what are called Röntgen rays.

In 1895 W. K. Röntgen, then professor of physics and director of the Physical Institute at Wurtzburg, while experimenting with a highly exhausted vacuum tube on the conduction of electricity through gases, noted that a paper screen covered with barium platinocyanid, which happened to be lying near, became fluorescent under the action of some radiation emitted from the tube, which tube at the time was enclosed in a box of black cardboard. Further investigation showed that this radiation had the power of passing through various substances which are opaque to ordinary light, and also affecting a photographic plate. Its behavior, moreover, was so curious in refraction and reflection that he doubted whether it was real light or not, and therefore he called it *x*-rays.

He also found that if a thick piece of metal like a coin were placed between the tube and the plate covered with the phosphorescent substance, a sharp shadow was cast on the plate, while pieces of wood cast only partial shadows. He found that as a general rule the greater the density of the substance, the greater the opacity to these rays. Thus, while the effect of these rays could pass through the flesh, it was stopped by the bones, so that if the hand were held between the discharged tubes and a phosphorescent screen, the outline of the bones was distinctly visible as a shadow on the screen. This was, indeed, a great discovery, which led to his receiving the Rumford medal from the Royal Society of England, and to these peculiar rays being now generally named the Röntgen rays.

The subject, however, which is of particular interest to us is the very general employment of the Röntgen rays for their effect upon both superficial and deep-seated malignant growths. This has occupied the attention of pathologists and surgeons in different parts of the world. (Note.—A summary of these observations made in America and Europe is given in an elaborate article by Dr. George E. Pfahler, of Philadelphia, in the *Chicago Journal of the American Medical Association* of May 1, 1915, page 1477.)

Thus epithelioma, under the influence of the Röntgen rays, undergoes degeneration and seems to melt away, while the surrounding healthy tissues show no effect. Further, it has been shown by dissec-

tion that the cancer shells undergo degeneration before any effect is shown on the healthy cells.

Thus, P. Haendly states in his *Surgical and Gynecological Journal* of April 9, 1914, that he found a treatment of two or three weeks' duration leading to such a permanent injury in the growth of the cancer cells as to cause its complete destruction.

Dr. Boggs, in an article on the Röntgen treatment of cancer of the breast (*New York Medical Journal*, November 12, 1910), reports that 5 of 20 patients unfavorable for operation were sufficiently benefited to justify the treatment. The pain was relieved for a period averaging a year. In every case the mass was reduced in size, and each patient was able to perform her usual duties and be with her family, free from pain and the offensive odor so distressing in carcinoma.

Dr. L. Freund, in the same journal, January, 1914, reports 39 cases of cancer of the breast, in which 2 were unaffected, but in all the rest the improvement for a greater or less period consisted in recovery from subjective symptoms. In one case after four years of Röntgen treatment there was complete recovery.

Special mention is made by different authors in Germany, such as Krönig, Gauss, Krinski, and Königsberger, of apparent clinical cures of organs within the abdomen, especially of the uterine cancers, by the use of the Röntgen rays; so that in America and in Europe there are societies formed for Röntgen therapy. All we need say now is that these reported cures for otherwise inoperable cases of cancer are sufficiently numerous and well established to lead us to hope that by this means a good prospect has arisen for a relief of the most terrible malady that can afflict the human frame.

One fact, however, is thus demonstrated, that cancer tissue is not a degeneration of normal tissues, as was formerly widely believed, but is an entirely new growth infiltrating the normal tissue, and that we have by the effect of the Röntgen rays a demonstration that malignant growths are, after all, truly parasitic invaders, and hence may be destroyed separately, while the normal cells are left intact.

In conclusion, we may say on this subject that one positive cure is worth more than a score of negative results.

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